

# 2015 AGRICULTURAL WATER MANAGEMENT PLAN



July 2017

# **Prepared by Stockton East Water District**

**Pursuant to Water Code Section 10826**

## **Preface**

Agricultural Water Management Plan was prepared by Stockton East Water District following the requirements of the Water Conservation Act of 2009 (SB x7-7) and Governor Brown's April 1, 2015 Executive Order B-29-15. SB x7-7 requires all agricultural water suppliers greater than 25,000 acres in size to prepare and adopt an Agricultural Water Management Plan as set forth in the California Water Code and the California Code of Regulations on or before December 31, 2015 and every five years thereafter. Governor Brown's April 1, 2015 Executive Order B-29-15 directs agricultural water suppliers to develop a drought management plan and incorporate it into the Agricultural Water Management Plan by the December 31, 2015 deadline.

The resources used to develop this plan were the 2015 Agricultural Water Management Plan Guidebook and Governor Brown's April 2015 Executive Order. The resolution of adoption is provided on the following pages. In 2014, Stockton East Water District received approval for its Water Management Plan from U.S. Bureau of Reclamation. The contents of the federal plan were used in the preparation of this plan in accordance to criteria established by DWR.

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### Glossary of Acronyms and Terms

Acronym or Term	Meaning
AB 3030	Assembly Bill 3030
ac-ft	Acre-Feet (1 AF = 352,851 gallons)
AWMP	Agricultural Water Management Plan
BMP	Best Management Practice
CALSIM	California Water Resources Integrated Modeling System
CCWD	Calaveras County Water District
CIMIS	California Irrigation Management Information System
CRHCP	Calaveras River Habitat Conservation Plan
CSJWD	Central San Joaquin Water Conservation District
CWC	California Water Code
DJW WTP	Dr. Joe Waidhofer Water Treatment Plant
DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utility District
ETc	Crop Evapotranspiration
EWMP	Efficient Water Management Practice
Executive Order	Executive Order B-29-15, By Governor Brown, April 1, 2015
GWMP	Eastern San Joaquin Groundwater Basin Groundwater Management Plan, Multi Agency, Adopted in 2005
IPCC	Intergovernmental Panel on Climate Change
IRWMP	Integrated Regional Water Management Plan
ITRC	Irrigation Training and Research Center
MGD	Million Gallons per Day
M&I	Municipal and industrial
Reclamation/USBR	United States Bureau of Reclamation
SCADA	Supervisory Control and Data Acquisition
SBx7-7	Water Conservation Act, Senate Bill x7-7 of 2009
SEWD or District	Stockton East Water District
TAF	Thousand Acre Feet
USACE	United States Army Corps of Engineers
UWMP	Urban Water Management Plan, Adopted in June 28, 2016
USBR WMP	United States Bureau of Reclamation Water Management Plan, Adopted in 2014

## **1 Introduction**

### **1.1 District History and Organization**

Stockton East Water District (SEWD) was formed in 1948 under the 1931 Water Conservation Act of the State of California. SEWD was originally organized as the Stockton and East San Joaquin Water Conservation District, an independent political subdivision of the state government. SEWD is responsible for acquiring a supplemental water supply and developing water use practices that will secure a balance between SEWD's surface and groundwater supplies.

From 1948 to 1963, SEWD focused its efforts on water resource planning by evaluating groundwater conditions and determining requirements for supplemental water. These intensive efforts on the part of SEWD and other local agencies resulted in the construction of New Hogan Dam in 1964. SEWD signed a contract for supplemental surface water with the United States Bureau of Reclamation (Reclamation) in 1970 (Attachment A). Also in 1970, SEWD and Calaveras County Water District (CCWD) signed a contract that assigned SEWD 56.5 percent of the yield from New Hogan Reservoir (Attachment A).

From its inception until 1962, SEWD's financial structure was dependent upon property taxes. In 1963, the Governor of California signed a bill establishing SEWD's right to levy groundwater use fees and surface water charges. SEWD used the additional revenue to contract for New Hogan Reservoir water. About this time, SEWD began registering groundwater wells within the district, while check dams were built on the Calaveras River and Mormon and Mosher Sloughs to control surface irrigation water and promote groundwater recharge. In addition, SEWD became actively involved in the pursuit of projects to mitigate significant groundwater issues, which included declining aquifer levels, pumping depressions under urban Stockton, and the continuing threat of saline intrusion in wells near the Delta.

In 1971 by Special Act of the Legislature, SEWD boundaries were expanded from its original 79,500 acres to approximately 114,000 acres to include the entire Stockton urban area and the District was granted additional powers to oversee the groundwater basin. Plans were initiated for a 30 million gallon per day (MGD) drinking water treatment plant. In 1975, a district-wide election resulted in the approval of a \$25 million bond to fund the new plant. The Dr. Joe Waidhofer Water Treatment Plant (DJW WTP) was constructed in 1977 and began operation in 1978. In 1979, the Independent Benefit Commission concluded that the new drinking water treatment plant was a benefit to Stockton's planning areas. In 2005, SEWD annexed an additional 27,000 acres into the district. Today, SEWD's area encompasses approximately 143,300 acres.

In 1983, SEWD and the Central San Joaquin Water Conservation District (CSJWCD) contracted with USBR for annual allocations of 75,000 and 80,000 acre-feet (ac-ft), respectively, from New Melones Reservoir (Attachment B). Also in 1983, SEWD expanded its surface water irrigation capabilities by constructing the 12,000 gallons per minute Potter Creek Pump Facility to facilitate diversions from New Melones Reservoir.

In 1991, the DJW WTP was expanded to 40 MGD to accommodate increased demand from Stockton's urban areas. Construction of the New Melones Conveyance System, in



anticipation of a new water supply from the New Melones Reservoir, was completed in 1994.

In 2005, SEWD implemented a \$7.1 million Efficiency Enhancement Project, which improved the water treatment plant's chemical mixing and settling efficiency and provided delivery of 11 percent more drinking water to the Stockton urban area.

In 2006, SEWD implemented a \$3.8 million upgrade and modernization of its water treatment plant high service pump station. This upgrade allows SEWD to meet the various pumping requirements of its retail customers and increased pump capacity from the Efficiency Enhancement Project. In 2006, SEWD upgraded the WTP to include a parallel 27.6-million gallon per day (MGD) process train north of the existing pretreatment complex for a total treatment capacity of 65 MGD.

Under the current Reclamation operation of New Melones Dam, SEWD and CSJWCD are provided with up to 155,000 ac-ft of water from New Melones Reservoir annually. Water allocation amounts are based on the March-September water forecasted inflow and the February end of month storage in New Melones each year.

## **1.2 Requirements of SB x7-7**

The Water Conservation Bill of 2009 (SBx7-7) amends the California Water Code (CWC) Division 6 with regards to agricultural and urban water management by adding Part 2.55 and replacing Part 2.8. Specifically, SBx7-7 requires all agricultural water suppliers to prepare and adopt an AWMP as set forth in the Bill on or before December 31, 2012. The plan must be updated by December 31, 2015 and then every 5 years thereafter. Additionally, the Bill requires suppliers to implement certain efficient water management practices (EWMPs).

Specifically, under CWC section §10608.48, all agricultural water suppliers are required to implement the following critical EWMPs:

- 1) Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of §531.10.
- 2) Adopt a pricing structure for water customers based at least in part on quantity delivered.

Further, suppliers are required to implement the following conditional EWMPs, if they are locally cost effective and technically feasible:

- 1) Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.
- 2) Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.
- 3) Facilitate financing of capital improvements for on-farm irrigation systems.
- 4) Implement an incentive pricing structure that promotes one or more of the following goals:
  - a) More efficient water use at the farm level.
  - b) Conjunctive use of groundwater.
  - c) Appropriate increase of groundwater recharge.
  - d) Reduction in problem drainage.

- e) Improved management of environmental resources.
- f) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.
- 5) Expand or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance, and reduce spillage.
- 6) Increase flexibility in water ordering by, and delivery to, water customers within operational limits.
- 7) Construct and operate supplier spill and tailwater recovery systems.
- 8) Increase planned conjunctive use of surface water and groundwater within the supplier service area.
- 9) Automate canal structures.
- 10) Facilitate or promote customer pump testing and evaluation.
- 11) Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress reports.
- 12) Provide for the availability of water management services to water users. These services may include, but are not limited to, all of the following:
  - a) On-farm irrigation and drainage system evaluations.
  - b) Normal year and real-time irrigation scheduling and crop evapotranspiration information.
  - c) Surface water, groundwater, and drainage water quantity and quality data.
  - d) Agricultural water management educational programs and materials for farmers, staff, and the public.
- 13) Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.
- 14) Evaluate and improve the efficiencies of the supplier's pumps.

Agricultural water suppliers not in compliance with the law are not eligible for state water grants or loans. Section 7 of this document provides details on the federal version of EWMPs. A summary of the status of the EWMPs is included in section 8 of this document.

### **1.3 Other Water Management Activities**

In 1995, SEWD adopted a Groundwater Management Plan (GWMP) in accordance with Assembly Bill 3030 (AB 3030). The goal of the GWMP is to continue the district's efforts to protect existing water supplies, to relieve pressure on the local groundwater basin by seeking supplemental surface water supplies for conjunctive use, and to maintain pressure on USBR to meet the contracted delivery amounts for New Melones water.

In 2005, SEWD adopted the Eastern San Joaquin Groundwater Basin Groundwater Management Plan prepared by the Northeastern San Joaquin County Groundwater Banking Authority in compliance with AB 3030 and SB 1938 and pursuant to California Water Code Section 10750 et seq., replacing the 1995 Plan. The comprehensive plan developed by those agencies that overlay the local groundwater basin reviews, enhances, assesses and coordinates existing groundwater management policies, and programs in Eastern San Joaquin County, and develops new policies and programs to ensure the long-term sustainability of groundwater resources in Eastern San Joaquin County. In 2014, SEWD adopted their federally required Water Management Plan. This 5-year

plan was prepared using the United States Bureau of Reclamation (Reclamation) 2011 Standard Criteria for Evaluating Water Management Plans. Reclamation Water Management Plans are required by the Reclamation Reform Act of 1982 and the Central Valley Project Improvement Act of 1992. The Standard Criteria is used by both agricultural and urban contractors of various sizes and complexities.

In 2016, SEWD adopted a Resolution to become a Groundwater Sustainability Agency (GSA) under the requirements of the Sustainable Groundwater Management Act (SGMA). In 2017, SEWD entered into a Joint Powers Agreement forming the Eastern San Joaquin Groundwater Authority to work with other GSAs to prepare a Groundwater Sustainability Plan for the basin under SGMA.

## **2 Plan Preparation**

### **2.1 AWMP Preparation**

This AWMP was prepared in accordance with SBx7-7.

### **2.2 Public Participation**

Public participation in the development of this Plan included:

- Notification via e-mail to the County of San Joaquin and City of Stockton, of SEWD's intent to prepare an Agricultural Management Plan on July 6, 2017;
- Publication in the Stockton Record on July 12, 2017 and July 17, 2017 of the time and place of a public hearing for public review and comment of the draft Plan;
- Posting of the draft Plan on the SEWD's web page on July 11, 2017, including instructions for reviewers to submit comments;
- Posting of the draft AWMP for public review on July 11, 2017;
- Public hearing of the draft Plan at a regularly scheduled Board of Directors meeting on July 25 2017;
- Adoption of the final AWMP at a regularly scheduled Board of Directors meeting on July 25, 2017; and
- Copies of the adopted AWMP to the following parties within 30 days of adoption:
  - City of Stockton and Cal Water
  - County of San Joaquin
  - Cesar Chavez Central Library
  - Local Agency Formation Commission of San Joaquin County
  - California Department of Water Resources
  - California State Library

The public is invited to attend all Board meetings and time is reserved on each agenda for public comments. The District web site ([www.sewd.net](http://www.sewd.net)) posts the agendas of all Board meetings along with the most recent Board minutes, newsletters, and other important information. Comments can be submitted via e-mail. Documentation of public participation is provided in Attachment M.

SEWD distributes a newsletter biannually to publicize important information. Also, SEWD relies on its staff to keep customers informed of the latest water management information.

### **2.3 Regional Coordination**

SEWD coordinates the operation and maintenance of the District cooperatively with San Joaquin County Flood Control and Water Conservation District, and coordinates with neighboring agencies, as appropriate. The San Joaquin County Flood Control and Water Conservation District Staff, and SEWD have worked cooperatively and adaptively as an ongoing collaborative effort on water management initiatives, programs, and will continue this relationship into the future.

Per Water Code §10821(a) requirements, the District coordinates the preparation of its AWMP with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable. A notice of preparation is sent out, published in the news article, and then a public hearing is held at the District for Public comment.

### 3 Background and Description of SEWD

#### 3.1 District Formation

As described previously, this AWMP has been prepared in accordance with SBx7-7 and by Executive Order B-29-15.

#### 3.2 Size and Location of Service Area

Stockton East Water District is located in San Joaquin County (**Figure 1**) serves agricultural users, and is a wholesale water agency of potable water to retail water suppliers serving the City of Stockton, the California Water Service Company, and San Joaquin County. The District covers 143,000 acres of which between 52,000 to 56,000 acres are irrigated annually. The total population within the District is just under 350,000 (Table 1). Irrigated lands are primarily east of the City of Stockton. Table 1 below shows the population served by the District through the retail water suppliers.

**Table 1. Current and projected 2020 wholesale population.<sup>a</sup>**

Urban Contractors	Wholesale Population	
	Current and Projected	
	2015	2020
City of Stockton <sup>b</sup>	170,417	181,862
Cal Water <sup>c</sup>	170,414	173,676
San Joaquin County <sup>d</sup>	8,184	8,184
Total Population	349,015	363,722

<sup>a</sup>Information taken from the 2015 City of Stockton's Urban Water Management Plan.

<sup>b</sup>City of Stockton water system population from draft UWMP.

<sup>c</sup>Cal Water population from Water Resources Planning Department Analysis Worksheets for Stockton District, January 2016.

<sup>d</sup>Population within the Lincoln Village and Colonial Heights areas.

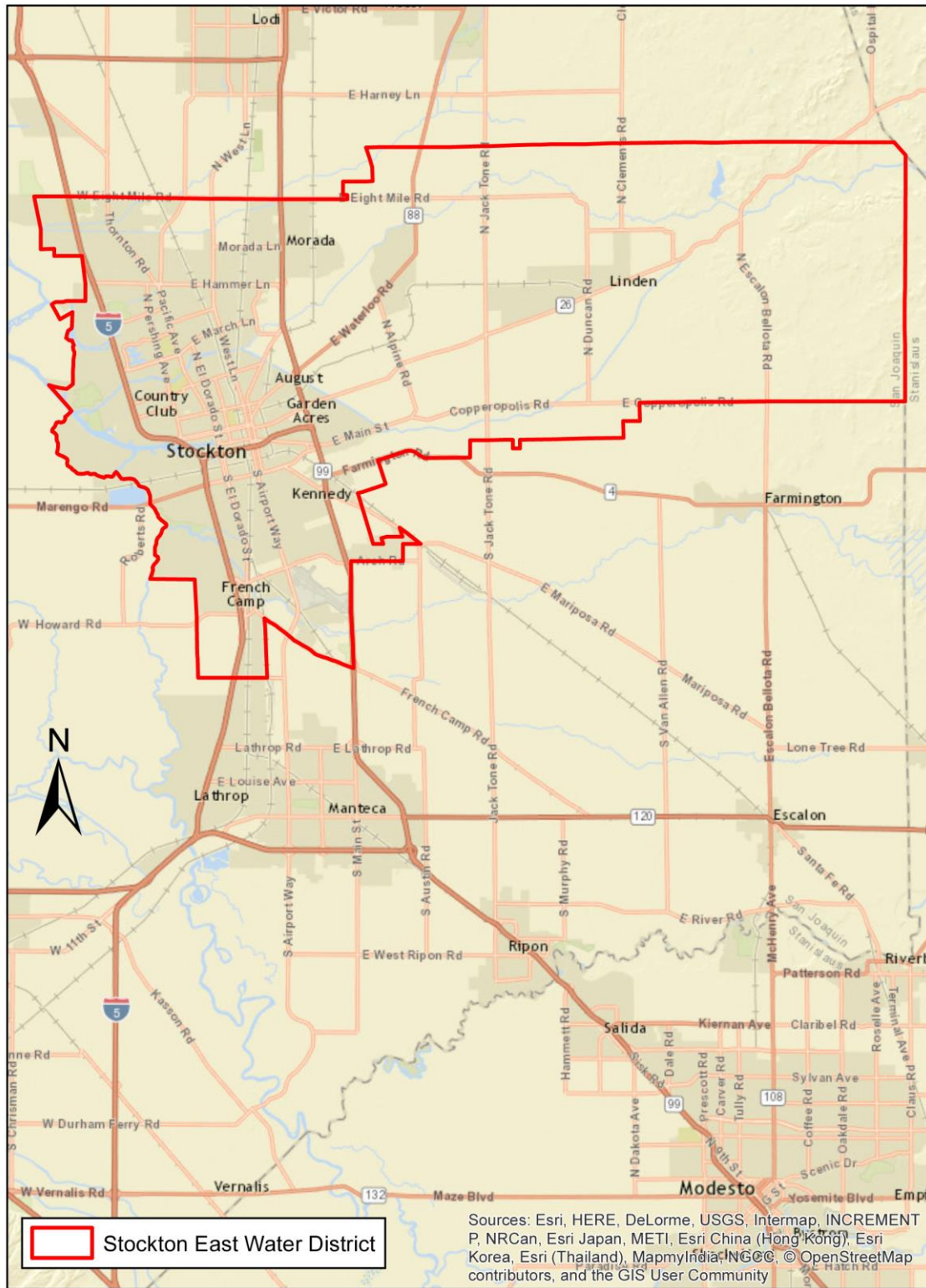


Figure 1. Stockton East Water District service area boundaries.

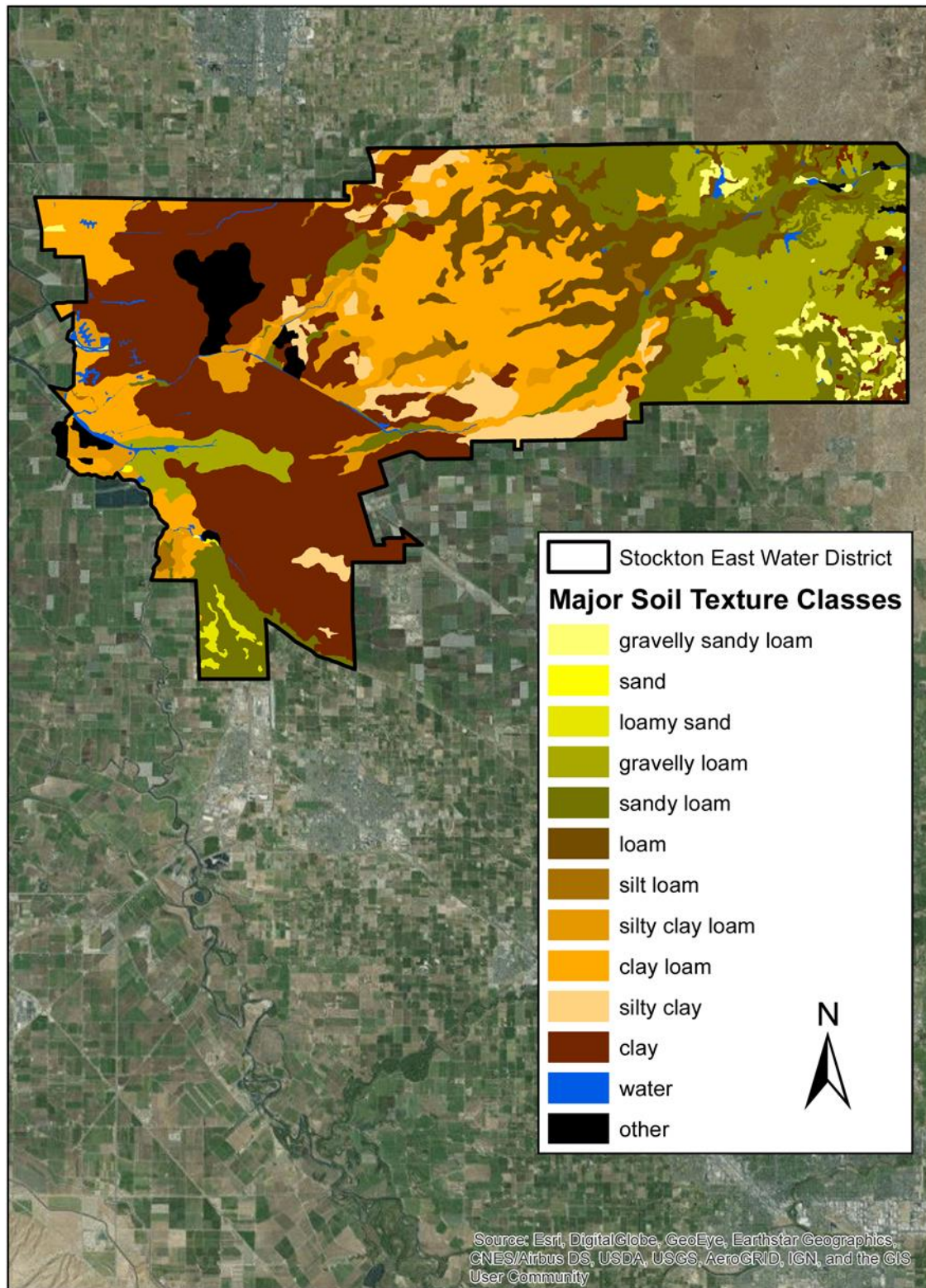
### **3.3 SEWD Distribution System**

SEWD distributes surface water through unlined natural channels on the Calaveras River, Mormon Slough, Mosher Slough, Potter Creek, and Diverting Canal from which surface water pump water. Irrigation also occurs from the Lower Farmington Canal, a District unlined canal and Peters Pipeline, a distribution pipeline providing water to agriculture and the DJW WTP. SEWD diverts water on the Calaveras River by means of the Bellota Weir that conveys into a 13-mile pipeline to the 65 MGD DJW WTP. Four regulating reservoirs are located at the treatment plant with a capacity of approximately 120 ac-ft. SEWD's distribution system has 17.5 miles of unlined canals and 19 miles of piped conveyance. In addition, there are 64 miles of natural waterways and flood control canals. See Attachment C for a detailed distribution system map.

### **3.4 Terrain and Soils**

SEWD is located on the floor of the San Joaquin Valley in San Joaquin County with the City of Stockton lying at its western end. The land slopes gently upward as it extends to the east, comprised of basin soils (Figure 2) recent alluvial fans, and flood plain soils to an elevation of approximately 100 feet at the edge of the foothills of the Sierra Nevada. Table 2 lists soil types greater than 1,000 acres of area within the District. The eastern boundaries of SEWD are bordered by the adjoining foothills, which rapidly narrow the width of the District to the extent of the irrigable land lying along the Calaveras River within the foothills. SEWD extends along the Calaveras River for approximately 8 to 9 additional miles to the County line, between Calaveras, Stanislaus, and San Joaquin Counties, rising in elevation to approximately 170 feet.





**Figure 2. Major soil texture classes within Stockton East Water District service area boundaries.**

**Table 2. Soil map units representing areas greater than 1,000 acres within SEWD.**

<b>Map Unit Name</b>	<b>Acres</b>
Archerdale clay loam, 0 to 2 percent slopes	12,439
Cogna loam, 0 to 2 percent slopes	11,953
Redding gravelly loam, 0 to 8 percent slopes, dry, MLRA 17	8,079
Finrod clay loam, 0 to 2 percent slopes	6,459
Hollenbeck silty clay, 0 to 2 percent slopes	5,495
Stockton clay, 0 to 2 percent slopes	4,388
Pentz sandy loam, 15 to 50 percent slopes	3,443
Columbia fine sandy loam, drained, 0 to 2 percent slopes	3,164
Redding gravelly loam, 1 to 30 percent slopes, dry, MLRA 17	2,185
San Joaquin sandy loam, 0 to 2 percent slopes	2,161
San Joaquin sandy loam, 2 to 5 percent slopes	1,958
Jacktone clay, 0 to 2 percent slopes	1,896
Galt clay, 0 to 1 percent slopes, MLRA 17	1,887
Vignolo silty clay loam, 0 to 2 percent slopes	1,830
Pentz-Redding complex, 2 to 15 percent slopes	1,736
Boggiano clay loam, 0 to 2 percent slopes	1,689
Keyes-Redding complex, 2 to 8 percent slopes	1,645
Keyes-Bellota complex, 2 to 15 percent slopes	1,616
Pentz-Bellota complex, 2 to 15 percent slopes	1,406
Cogna fine sandy loam, 0 to 2 percent slopes, overwashed	1,399
Peters clay, 2 to 8 percent slopes	1,223
Stockton silty clay loam, 0 to 2 percent slopes, overwashed	1,072

### 3.5 Climate

SEWD is located in the heart of the fertile Central Valley of California. Based on the historical data (Table 3) obtained from the California Irrigation Management Information System (CIMIS) and the Western Regional Climate Center (WRCC), the District's service area average minimum and maximum monthly temperature ranges from 37 to 95 °F. Average annual rainfall is normally approximately 15 inches. Table 3 summarizes the District's climate conditions in representative areas based on the CIMIS and WRCC databases based on monthly averages of historic information.

**Table 3. Precipitation, temperature, and reference evapotranspiration from 1981 to 2015.**

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Manteca (CIMIS Station No. 70, WRCC Station No. 045303) <sup>a</sup>											Elevation: 40 feet		
Average ETo (in)	1.11	1.92	3.53	5.05	6.78	7.71	7.96	7.03	5.15	3.37	1.67	1.01	52.3
Max Temp. (°F)	53.7	61.1	66.3	72.4	80.9	88.6	93.2	91.5	87.7	77.7	61.1	53.8	--
Min Temp. (°F)	36.3	39.3	42.1	45.2	50.5	55.9	59.2	58.5	55.9	49.2	40.4	35.4	--
Precipitation (in)	1.65	1.35	1.52	0.95	0.21	0.09	0.12	0.23	0.24	0.97	1.58	1.51	10.4
Stockton Metro Airport (WRCC Station No. 048558) <sup>b</sup>											Elevation: 20 feet		
Max Temp. (°F)	53.7	60.6	65.9	72.8	81	88.5	94.2	92.7	88.3	78.3	64.4	54	--
Mini Temp. (°F)	37.6	40.4	42.6	46.1	51.6	56.9	60.4	59.7	57	50.2	42.2	37.5	--
Precipitation (in)	2.8	2.24	2.03	1.14	0.41	0.1	0.03	0.04	0.25	0.73	1.71	2.3	13.8
<sup>a</sup> Period of record: 1971 to 2000													
<sup>b</sup> Period of record: 1948 to 2015													

Microclimates within the service area are primarily based on elevation. Most of the Stanislaus River watershed lies in the upper elevations (over 7,000 ft mean sea level) of the Sierra Nevada, where there is abundant snowmelt. The headwater elevations in the Calaveras River watershed are about 5,000 ft mean sea level, and precipitation throughout most of the watershed is rarely in the form of snow. Because of the lack of snow storage in the Calaveras River watershed, New Hogan Dam operations are more difficult, since water releases are more frequent for flood control purposes, and not replenished by spring snowmelt.

### 3.6 Operating Rules and Regulations

SEWD maintains rules and regulations necessary for carrying out the provisions of the Special Act creating the District. Rules and regulations cover duties of the general management, employment, allocation of water, waste of surface water, maintenance, surface water diversions, land access, and enforcement and modification of rules.

The following is a summary of SEWD's agricultural water allocation policy. See Attachment D for more detailed information.

Riparian right users have first call on up to 13,000 acre feet of water from New Hogan Reservoir pursuant to a settlement agreement. Through contract, the urban area is guaranteed 20,000 ac-ft of water if supplies are available. Water is then allocated to all other surface water users.

The agricultural water shortage plan for dry year or drought conditions is described below. As Water Master of New Hogan Reservoir, SEWD assesses the water supply by April of each year. A sufficient volume to supply enough water for a full irrigation season is about 152 TAF to 161 TAF, based on 3 foot per acre irrigation practice for primary crops grown in the area within the district boundary. New Hogan generally has sufficient water to withstand two to three dry years.

As an initial assessment, if a water year is identified as a dry year, SEWD asks its customers for voluntary reductions in use. If a second subsequent year is identified as a dry year, SEWD still requests voluntary reductions, but identifies these reductions as critical. A third subsequent dry year may result in continued voluntary reductions, or may require mandatory reductions SEWD makes this determination at the beginning of the water year.

The District informs its customers of the available water supply, and any need for reductions, through its newsletter, as-well-as postcard reminders and the SEWD website. A final option is to allow diversions only by riparian users and the water treatment plant. In all water years, SEWD requires that its customers call the District in advance of diverting water, so that SEWD can adjust releases at the dam.

Customers are required to provide the following information 24 hours in advance of the diversion: location of diversion, name of owner or operator, beginning diversion time, pumping rate, and ending diversion time. In non-dry years, this request is voluntary. In dry years, the advance notice is mandatory, and the District may enforce penalties on customers who do not advise the District prior to their water use.

The postcard reminds customers of this penalty and official and actual lead times necessary for water orders and shut-off (agricultural only). In 2014, SEWD changed its voluntary notification policy to be mandatory. The District requires for a 48-hour notice. See rule 120 in Appendix D for additional details.

Policies cover return flows (surface and subsurface drainage from farms) and outflow (agricultural only). Soils within SEWD boundaries are permeable, so most irrigation tailwater penetrates rapidly beyond the root zone of the crops, and presents no problems during the irrigation season. Some drainage water collects in open farm ditches and flows to natural waterways where it is reused for irrigation. Present drainage practices present no problems to agriculture.

Transfer water policy is in the SEWD Special Act under Section 6. The policy specifies that SEWD can sell water outside the district, as long as the SEWD water users' needs are met first, and water is available. Customers are not allowed to transfer water to other users within the District.

### **3.7 Water Measurement**

Over time SEWD's has improved water measurement to support efficient management of the District's water resources and to support water resources planning. The basic approach is to meter all incoming flows and deliveries. In addition, outflows are monitored to prevent spill. The following sections discuss boundary and delivery measurement.

### **3.7.1 Boundary and System Flow Measurement**

Most of the irrigation water in SEWD is from the New Hogan Reservoir and is provided, on demand, to the best of SEWD's ability and tail end losses are closely monitored. In an average or below average water year, SEWD operates the irrigation water to minimize or prevent any tail end loss. SEWD's mandatory water ordering system and on-demand operations have prevented spills from over-releases, as well as tailwater from over-irrigation.

SEWD measures incoming flow from Goodwin Reservoir and Farmington Dam with ultrasonic meters, and at the DJW WTP with a venturi meter. The USACOE maintains a stilling well for calculating flows out of New Hogan Reservoir (Table 4).

Due to the supervisory control and data acquisition (SCADA) system, there is no loss of SEWD water that is under District control. In above average water years, the irrigation system is operated to ensure maximum recharge opportunities and minimize end of year releases required to evacuate flood control storage space in New Hogan. Wetter years, such as 2005 and 2006, result in higher system end loss. SEWD has no formal agricultural spill recovery system, but with grant funding through a Reclamation 2025 Challenge Grant, is implementing the SCADA system in the agricultural distribution system to help recover spills and minimize the limited system losses.

SEWD is improving its monitoring system to reduce spill and increase efficiency on the Calaveras River, Mormon Slough, Mosher Slough, Potter Creek, and at the Diverting Canal. It is estimated these improvements will ultimately conserve up to 3,600 ac-ft of water in an average or below average water year, which would then be available for agriculture, municipal and industrial, or recharge uses. The Project will enhance water supply reliability for SEWD and improve conditions in the Eastern San Joaquin County Groundwater Basin, which is designated as being in a state of critical overdraft (DWR 1980) and is subject to saline intrusion. The SCADA system remotely monitors 12 sites at key locations within the water distribution system and provides off-site water gate control at three locations. The system includes one flow monitoring and eleven, pool-level, monitoring sites.

At diversion turn out gates, Doppler radar type meters are used from the following manufacturers: MACE, SON TEK, and Gray Line. In addition to the Doppler style meters, the Bellota pipeline outflow at SEWD WTP is metered with a Rosemount venturi style flowmeter. The District employs field-metering staff to keep accurate records of each irrigation outlet calibration, and monitor the meters at the Bellota 54-inch pipe and at the DJW WTP on a daily basis.

**Table 4. Incoming flow measurement locations.**

Incoming Flow Location Name	Physical Location	Type and Manufacturer of Measurement Device	Accuracy
Goodwin Tunnel Outlets	Goodwin Reservoir	ultra sonic (SON TEK-IQ)	+/- 6% <sup>a</sup>
Farmington Dam Diversion	Farmington Dam	ultra sonic (SON TEK-Arogonaut)	+/- 6% <sup>b</sup>
treatment plant influent	Dr. Joe Waidhofer WTP	venturi	+/- 6% <sup>c</sup>
New Hogan Reservoir	New Hogan Reservoir	stilling well calculation	<sup>d</sup> adjusted per stream flow measurements
New Hogan Conveyance	Bellota Intake	(MACE)	+/- 1%
New Hogan Conveyance	Spill Way at Mormon Slough	(MACE)	+/- 1%

<sup>a</sup> The Goodwin Reservoir measurement device is calibrated four times a year, and maintained monthly.

<sup>b</sup> The Farmington Dam Diversion measurement device is calibrated and maintained four times a year.

<sup>c</sup> The DJT WTP measurement device is calibrated annually.

<sup>d</sup> Owned and maintained by USACOE

### 3.7.2 Delivery Measurement

For customers with a delivery measurement device the District uses propeller meters to measure deliveries on a volumetric basis or hour meters. For the delivery locations without a flow meter the District charges a fixed non-metered rate of 2.8 ac-ft per acre. The fixed rate charges are based on the amount of acres irrigated that are reported by the AG customer to the District.

In 2015, SEWD had a total of 201 agricultural delivery connections of which 191 are measured with McCrometer propeller meters (Table 5) and two are measured with hour meters and use an equation to convert to volume (see section 8.4). The eight connections (Attachment J) without measurement devices have been surveyed for retrofit with meters however, the plumbing configurations of the unmeasured connections do not have room for a measurement device. In the near future, the non-metered connections will be assessed for viable repairs, and to explore other types of measuring devices that could volumetrically quantify deliveries. In the interim, SEWD could make comparisons with the groundwater metering usage for customers who are non-metered and help address self-reporting discrepancies regarding the acreage being irrigated.

Irrigation delivery meters are read from mid-April through mid-October on a monthly basis. SEWD's records contain information on the location, acres irrigated, gate numbers, meter

numbers, water usage, crops irrigated, and miscellaneous information on growers' equipment and water history. The District employs field-metering staff to keep accurate records of each irrigation outlet calibration. Additionally, SEWD is looking into developing an ongoing program that would calibrate each meter every 5-years, so the District is in compliance with "SB- 88 and Emergency Regulation for Measuring and Reporting The Diversion of Water."

**Table 5. Listing of delivery point measurement devices along with associated details for 2015.**

Measurement Type	Number	Accuracy (+/- %) <sup>a</sup>	Reading Frequency (Days)	Calibration Frequency (Months)	Maintenance Frequency (Months)
McCrometer Propeller meter	191	+/- 6%	30	As needed	As needed

<sup>a</sup> New meter technology ensures accuracy +/-6% without the need for field calibration. See example of factory certification in Attachment K.

### 3.8 Water Rate Schedules and Billing

SEWD bills using both fixed and volumetric charges (Table 6). On an annual basis, the District evaluates the sufficiency of rates as-well-as possible increases under its enabling legislation and as otherwise required by California law. Therefore, the District will continue to monitor financial results to anticipate future necessary changes to its rate structure. Rate details are in Ordinance 42 (Attachment D).

**Table 6. Fixed and variable water charges for 2015.**

Fixed Charges			
Source	Charge units (\$/acre)	Units billed during year (acre-feet)	\$ Collected (\$ times units)
Surface water	\$23.00/ac-ft	1,323 ac-ft <sup>a</sup>	\$30,429
Groundwater	\$5.06 <sup>c</sup>	140,105 ac-ft <sup>ad</sup>	\$708,931
Volumetric Charges			
Source	Charge units (\$/ac-ft)	Units billed during year (ac-ft)	\$ Collected (\$ times units)
Surface water	\$23.00/ac-ft	9,953 ac-ft <sup>a</sup>	\$228,919 <sup>b</sup>

<sup>a</sup>Source: SEWD Crop Report.

<sup>b</sup>Actual per general ledger.

<sup>c</sup>Groundwater assessments calculated based on 2.8 ac-ft/ac of irrigated land.

<sup>d</sup>SEWD does not sell agricultural groundwater to its customers; SEWD assesses the use of the wells, based on acreage, as part of their mandate to protect the groundwater supply.

### 3.9 Water Shortage Allocation Policies and Contingency Plan

This section provides an overview of SEWD's water shortage allocation policies. Riparian right users have first call on up to 13,000 of water from New Hogan Reservoir. Through contract, the urban area is guaranteed 20,000 ac-ft of water if supplies are available. Water is then allocated to all other surface water users. The agricultural water

shortage plan for dry year or drought conditions is described below. As Water Master of New Hogan Reservoir, SEWD assesses the water supply by April of each year. A sufficient volume to supply enough water for a full irrigation season is 152 TAF to 161 TAF, based on 3 foot per acre irrigation practice for primary crops grown in the area within the district boundary. SEWD generally has sufficient water to withstand two to three dry years.

If a water year has been identified as a dry year, SEWD asks its customers for voluntary reductions in use. If a second subsequent year is identified as a dry year, SEWD still requests voluntary reductions, but identifies these reductions as critical. A third subsequent dry year may result in continued voluntary reductions, or may require mandatory reductions SEWD makes this determination at the beginning of the water year. The district informs its customers of the available water supply, and any need for reductions, through its newsletter, as well as postcard reminders and the SEWD website. A final option is to allow diversions only by riparian users and the water treatment plant.

In all water years, SEWD requires that customers call the District in advance of diverting water, so that SEWD can adjust releases at the dam. Per Rule 120 (Attachment D) customers are required to provide the following information 24 hours in advance of the diversion: name, phone number, pump id number, diversion rate, beginning date and time, end date and time, and run time, location of diversion, name of owner or operator, beginning diversion time, pumping rate, and ending diversion time. The District may enforce penalties on customers who do not contact the district prior to their water use. Postcards are mailed to all customers to remind them of this penalty. See Attachment D for more detailed information.

For an explanation of SEWD operational management strategies during water short years, refer to the Drought Management Plan (Attachment G). The Drought Management Plan was prepared based on Governor Brown's Executive Order B-29-15.

### **3.10 Policies Addressing Wasteful Use of Water**

Rule 120 of SEWD's Rules and Regulation (Attachment D) discusses waste of surface water, and establishes penalties for customers who do not request water 24 hours in advance, or do not inform the District of their cessation of use. A penalty of \$100 is assessed for the first failure to notify; \$200 for the second; and \$500 for each subsequent failure. No procedures have been established for wasting water once the customer diverts the water, as customer's pay for water received, and would not be expected to waste it.



## **4 Inventory of Water Supplies**

### **4.1 Introduction**

This section describes the various water supply sources within SEWD. In addition to the surface water supplied to growers, groundwater has been developed to supplement surface water deliveries. Precipitation also provides water for agricultural production; however, due to the variation in amounts from year to year and the timing of rainfall, outside of the irrigation season, it is not considered a reliable source.

### **4.2 Surface Water**

The District's surface water supplies are from New Melones Reservoir and New Hogan Reservoir. Until 1977, groundwater was the sole source of supply for domestic water users in the Stockton area. A supplemental surface water supply was established when the DJW WTP began operation in 1977. The DJW WTP began operation at 30 million gallons per day (mgd) and is now permitted to 65 mgd. The District receives surface water through agreements with the Reclamation for water from two sources: New Hogan Reservoir and New Melones Reservoir (Attachments A and B).

In general, most of the surface water used for agricultural irrigation in SEWD originates from New Hogan Reservoir. The balance of the agricultural water demands not met by available surface water each year is satisfied with customer pumped groundwater. Customer pumped groundwater is metered and customers are billed by the District for use.

The District has filed several water rights application to divert excess wet weather flow from Calaveras River, Littlejohns Creek, and other tributaries. Environmental review of the applications are nearing completion, and a hearing will likely be required before the State Water Resources Control Board before permits are issued.

#### **4.2.1 Surface Water Supply New Hogan**

The District receives water from the New Hogan Project pursuant to an August 25, 1970 contract with Reclamation, the District and Calaveras County Water District (CCWD). The contract provides for repayment and conservation use of the New Hogan Project. This contract allocates all water available at the reservoir to the two Districts, subject only to storage and release of water for flood control.

The allocation of water between the District and CCWD is subject to an August 25, 1970 contract between the District and CCWD providing for the use, repayment and administration of water from the New Hogan Project (Allocation Contract). The Allocation Contract allocates 56.5 percent of the yield from New Hogan Reservoir to the District, and the remaining 43.5 percent to CCWD. The total annual supply available to both the District and CCWD is approximately 84,100 ac-ft/yr in normal water years. The Allocation Contract also provides that any water not used by CCWD can be used by the District.

At the current level of CCWD use, the District can rely on about 83,000 ac-ft/yr of supply from the New Hogan Project in normal water years under safe yield operation. If CCWD

maintains its percentage entitlement (43.5 percent) and exercises it, the District's share would be reduced. It is assumed for this analysis that the reasonably available volume to the District is 80,000 ac-ft/yr for municipal and industrial supplies in all year types, as described in Section 5. New Hogan Reservoir receives its water supply primarily from rain runoff. The water storage capacity is 317,000 ac-ft.

The New Hogan Reservoir was constructed in 1964 on the Calaveras River and is located approximately 30 miles east of Stockton, south of State Highway 26 in Calaveras County. The District is the water master and controls dam releases for irrigation and municipal use for the District and CCWD during non-flood control periods. The United States Army Corps of Engineers (USACE) operates the dam for flood control. The New Hogan supply is transmitted from the reservoir through the Calaveras River, a series of creeks, diversion structures, and a dedicated pipeline to be treated at the DJW WTP.

#### **4.2.2 New Melones**

The District receives water from the New Melones Project pursuant to a December 19, 1983 contract with USBR allocating the District 75,000 acre feet annually. The New Melones supply is transmitted from the Goodwin reservoir through Goodwin tunnel, a series of creeks, diversion structures, and canals to be treated at the DJW WTP.

New Melones Reservoir is a part of the Central Valley Project (CVP), receives its water from rain and snowmelt runoff, and has a capacity of 2.4 million ac-ft. It is located approximately 40 miles east of Stockton, north of State Highway 120 in Stanislaus County. Central San Joaquin Water Conservation District (CSJWCD) also has a water supply contract with USBR for the New Melones Project.

Together the District and CSJWCD are entitled to up to 155,000 ac-ft of water from New Melones Reservoir annually. Water allocation amounts are based on the March-September water forecast inflow and the February end of month storage in the New Melones Reservoir each year, to be used for municipal and industrial or agricultural use. This water is subject to cutbacks based on the the hydrology of the Stanislaus River and State Water Board and other regulatory requirements on New Melones water right permits and operations.

Water obtained from New Hogan Reservoir is distributed within SEWD by its New Hogan Water Conveyance System. Similarly, water obtained from New Melones Reservoir is distributed within SEWD by its New Melones Water Conveyance System. For the reporting period of 2013-2015 deliveries averaged 55,490 acre-feet (Table 7).

**Table 7. Surface water supplies for 2013-2015.**

Source	2013	2014	2015
	acre-feet		
New Melones (CVP)	8,037	8,235	143
New Hogan (Local)	70,781	62,085	17,189
Total	78,818	70,320	17,332

### **4.3 Groundwater Supply**

The District currently has five wells located at the DJW WTP site used for emergency purposes only. Historically, the District has not pumped, or provided groundwater for municipal and industrial use. The District does not intend to begin pumping groundwater in the future unless an emergency occurs. If groundwater is needed to supplement surface water, it is blended with surface water from the District for processing through the DJW WTP, and subsequently delivered to the City of Stockton, County of San Joaquin, and Cal Water.

SEWD is a conjunctive use District and overlies the Eastern San Joaquin Groundwater. The basin encompasses 938 square miles (600,320 acres) with a safe yield of 689,920 ac-ft/yr. Full details on the plan are available in the Eastern San Joaquin Groundwater Basin Groundwater Management Plan;

<http://www.gbawater.org/Portals/0/assets/docs/IRWMP-2014/Groundwater-Management-Plan-Final.pdf>

At present, recharge to the groundwater basin within SEWD is furnished by regulated releases from New Hogan Reservoir down the channel of the Calaveras River. These releases are regulated by SEWD to obtain the greatest beneficial use for the District. Recharge of the groundwater occurs from percolation in both the Calaveras River and Mormon Slough. Recharge measurements made of the Calaveras River system indicate that there is an average percolation between New Hogan Dam and Jenny Lind of 6 cfs; and between Jenny Lind and Bellota of >7 cfs (MBK 1969). Without check dams in place, below Bellota the percolation is 13 cfs each in Mormon Slough and the old Calaveras River; with the check dams in place, the percolation rates increase to 19 cfs and 31 cfs, respectively. Current recharge operations verify all but the Mormon Slough percolation quantities.

Assuming that the check dams are in place and full for the maximum period permitted (213 days) and that sufficient water is flowing in the channels, the maximum annual percolation for the remainder of the year (152 days) to permit maximum infiltration is 34,000 ac-ft. However, water during average years there is not sufficient water available for recharge at the maximum period. Recharge for an average year is estimated at 26,000 ac-ft of which approximately 21,000 ac-ft percolates below Bellota.

DWR previously identified critically over drafted basins in Bulletin-118-80 and the 2003 update. The Eastern San Joaquin Subbasin is identified as a critically overdrafted groundwater basin in Bulletin 118. As defined in the SGMA, "A basin is subject to critical overdraft when continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts." Municipal and agricultural uses of groundwater within San Joaquin contribute to an overall average use of groundwater estimated to be 761,828 ac-ft/yr for agricultural uses and 47,493 ac-ft/yr for municipal and industrial uses. Historically, groundwater elevations have declined from about 40 to 60 feet averaging approximately 1.7 feet per year. As a result, a regional cone of depression has formed in Eastern San Joaquin County creating a gradient that allows saline water underlying the Delta region to migrate northeast within the southern portions of the City.

Groundwater use in SEWD is a mix of District and customer pumping. For the reporting period of 2013-2015 pumping ranged from just under 123,000 in 2013 to just over 146,000 in 2015 a dry year (Table 8). For the three year period the average amount pumped was 131,940 acre-feet.

**Table 8. District and customer groundwater pumping 2013-2015.**

Month	2013		2014		2015	
	Supplier	Customers	Supplier	Customers	Supplier	Customers
	acre-feet					
January	0		0		0	
February	0		0		0	
March	0		0		0	
April	0		0		0	
May	0		0		184	
June	0		0		206	
July	0		0		848	
August	0		0		949	
September	0		0		967	
October	0		0		1,015	
November	0		0		972	
December	0		0		841	
sub-total	0	122,999	0	126,481	5,982	140,358
Total	122,999		126,481		146,340	

#### 4.4 Other Water Supplies

There are no other water supplies within the District. However, the District stores surface water underground via direct recharge into percolation ponds located on District property. Since 2003, the District has directly recharged and stored 54,889 ac-ft of surface water. Between 2011 and 2015 the District stored an average of 4,000 ac-ft/yr. The District will increase groundwater recharge as additional sources of supply become available and with construction of additional percolation basins. Surface water banked supply is therefore currently 54,889 ac-ft. As the District increases the surface water banked in the future, this number will increase.

In addition, the District has stored surface water underground as a result of the in-lieu recharge undertaken by the District since 1976 when surface water deliveries replaced groundwater pumping in both the agricultural and urban area.

#### 4.5 Water Quality Monitoring

There are no current surface water quality problems that limit SEWD' surface water use as an irrigation water source. However, Phytophthora has been identified in Calaveras River water and is of concern to some irrigators due to Phytophthora's potential to impact plants. SEWD's water quality lab staff monitor the following raw water constituents for operational purposes:

- Turbidity –NTU
- pH
- Chlorine Residual
- Cryptosporidium (FGL test samples)

- Back T's (Total Coliform & E. coli)
- Total Organic Carbon (TOC's)
- Heterotrophic Plate Count (HPC)

SEWD does not post the numerical values on the District's website. However, SEWD does publish a information about water quality parameters at;

[http://sewd.net/?page\\_id=386](http://sewd.net/?page_id=386)

In addition, 21 other constituents and indicators are monitored at eight different sampling locations, that are identified in section 4.4.1 below. In general, groundwater quality within the Eastern San Joaquin Subbasin is suitable for municipal, industrial, and agricultural supplies. However, as discussed in Bulletin 118, as a result of declining water levels, poor quality water has been moving east along a 16-mile front on the east side of the Delta (DWR, 1967).

The degradation was particularly evident in the Stockton area where the saline front was moving eastward at a rate of 140 to 150 feet per year. Data from 1980 and 1996 indicate that the saline front has continued to migrate eastward up to about one mile beyond its 1963 extent (USACE 2001). Large areas of elevated nitrate in groundwater exist within the subbasin located southeast of Lodi and south of Stockton and east of Manteca extending towards the San Joaquin – Stanislaus County line. (DWR, 2006) It is expected that additional surface water from New Melones Reservoir and other sources used in groundwater recharge efforts will stabilize the movement of the saline water.

In an attempt to mitigate for reduced surface water supplies available for urban uses in 2015, the District pumped banked surface water. Starting in July 2015, the District pumped from five wells located on District property at a total continuous pumping rate from 4,000 to 7,500 gpm. With this pumping, the District has not detected any contaminants in the pumped stored surface water.

#### 4.5.1 Surface Water Quality

SEWD began irrigation water quality monitoring for surface water at seven key points in the irrigation distribution system in 1997. On an annual basis SEWD samples eight offsite locations (Table 9) for typical water quality parameters (Ca, Mg, Na, K, alkalinity, sulfate, Cl, nitrate, B, F, Cu, Fe, Mn, Zn, pH, electrical conductivity, and total dissolved solids) important to agricultural irrigation. See Attachment I for detailed reports for 2010-2016.

**Table 9. Surface water sampling locations.**

Code	Location
CR-1	New Hogan Reservoir
CR-5	Calaveras River at Bellota
MS-1	Beginning of Mosher Slough
MS-2	Mosher Slough after last irrigator
CR-6:	Calaveras River after last irrigator
PC-1	Potter Creek after last irrigator
M-1	Mormon Slough after last irrigator
PP-1	Peters Pipe at Potter Creek siphon

All results indicate a high-quality water supply that is suitable for irrigation of all crops grown in the District. Table 10 lists the average value for 2013-2015 at each monitoring site for the major cations, anions, and other components. For the 2013-2015 period the electrical conductivity ranged from 0.1 to 0.2 dS/m and pH ranged from 7.3 to 8.0 (Table 10). All results are available upon request.

<https://sewd.net/water-quality/>

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**Table 10. Average surface water quality monitoring for major ions and other constituents in irrigation water for 2013-2015.**

	Monitoring Location (See Table 9 for full name)							
Constituent	CR-1	CR-5	MS-1	MS-2	CR-6	PC-1	M-1	PP-1
Cations	mg/l							
Calcium	21.3	20.3	20.7	21.3	21.3	21.0	21.0	6.5
Magnesium	8.0	8.3	8.0	8.7	8.3	8.7	9.0	2.0
Potassium	2.0	1.7	1.7	2.3	2.7	2.7	2.7	1.0
Sodium	6.7	6.3	6.7	7.3	7.0	8.3	8.0	2.5
Anions								
Carbonate	<10	<10	<10	<10	<10	<10	<10	<10
Bicarbonate	97	93	90	93	83	100	103	30
Sulfate	11	11	12	12	13	11	13	2
Chloride	5	5	5	5	6	6	6	1
Nitrate	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Flouride	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other Constituents								
pH	7.3	7.9	7.7	7.6	7.9	7.5	7.8	8.0
Electrical Conductivity (dS/m)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1
Sodium Adsorption Ratio	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.2

#### 4.5.2 Groundwater Quality

SEWD does not monitor groundwater on a routine basis but by request from private well owners. The District provides a courtesy monitoring service that can include an assessment for potential water quality issues. For private well owners, SEWD monitors specific conductance of groundwater quality on an as requested basis. Currently one well owner in French Camp requests the service due to conductivity ranging from 600-2,500 umhos/cm (0.6-2.5 dS/m) with an average of 1,000 umhos/cm (1 dS/m).

For the groundwater basin there are two groundwater quality problems; saline intrusion and agricultural chemical contamination. Extensive groundwater pumping has caused movement of the saline waters eastward from under the Delta. Poor quality groundwater in the south Stockton area is barely adequate for some agricultural activities and would not be acceptable for urban uses. The saline front is projected to move beyond State Highway 99 by the year 2020. It is expected that additional surface water from New Melones Reservoir and other sources used in groundwater recharge efforts will stabilize the movement of the saline water.

After detecting dibromochloropropane (DBCP) in groundwater, SEWD conducted a study to investigate groundwater contamination resulting from irrigation practices. The 1986 study found that no major or extensive water quality problems exist within SEWD, except for three pesticides, DBCP/ 1,2-D (1,2 dichloropropane), a contaminant of Telone II, and EDB (ethylene dibromide), which were identified as being of concern. On the borders of SEWD to the north (south of the City of Lodi) is an area where soil and groundwater are contaminated with DBCP and 1,2-D. Groundwater in both areas is expected to enter the SEWD boundaries by the year 2020 and result in the degradation of district groundwater.

## **5 Description of Water Uses**

### **5.1 Introduction**

This section describes the various water uses within SEWD. For each use, a multi-year water accounting covering the period from 2013 to 2015 is presented. This accounting quantifies all significant inflows and outflows of water to and from SEWD.

Drivers of water management in a given year include available surface water supply, precipitation within the SEWD service area, and atmospheric water demand.

### **5.2 Hydrologic Year Types in SEWD**

A multi-year water accounting is necessary to evaluate SEWD water management implications of variability in surface and groundwater water supply, precipitation, and other changes in the hydrology.

For 2013-2015 precipitation and reference evapotranspiration averaged 8.34 and 55.02 inches (DWR CIMIS). Irrigation demand averaged 156,615 acre-feet from 2013 to 2015.

### **5.3 Water Uses**

SEWD supplies irrigation water for agriculture as well as water for urban consumption. The primary use of water by agriculture is for crop consumptive use, which is also stored in the groundwater basin (surface water - banked) for use when needed in the future.

#### **5.3.1 Agricultural**

Agricultural irrigation is the primary water use within the District. Total water required to meet the evapotranspiration needs of the crops grown varied from just under 152,000 to almost 161,000 acre-feet, per irrigation season from 2013-2015 (Table 11). Effective precipitation supplies a portion of each year's demand.

Dominant crops in SEWD include walnuts, cherries, and other orchard crops that account for about 2/3 of total crop water demands. Other uses of irrigation water include leaching to prevent the buildup of salts in the soil profile and frost protection. However, due to the low salinity of surface water, the required leaching fraction is small for the crops grown in the District and is not estimated. Additionally, water applied for frost protection is typically applied outside of the irrigation season and is not estimated.



**Table 11. Water use by crop for 2013-2015.**

Crop	2013		2014		2015	
	Acreage	Water Use (ac-ft)	Acreage	Water Use (ac-ft)	Acreage	Water Use (ac-ft)
Walnut	25,169	70,472	26,708	74,782	28,142	78,797
Cherries	11,033	30,893	11,021	30,858	11,108	31,103
Vineyard	4,819	13,492	5,174	14,486	5,517	15,447
Tomatoes	1,168	3,271	1,209	3,384	1,415	3,962
Pasture	1,804	5,052	1,760	4,928	1,345	3,766
Apples	1,037	2,904	1,013	2,837	1,008	2,821
Corn	1,686	4,721	1,487	4,164	782	2,190
Other	8,139	21,155	8,466	21,536	8,796	22,822
Total	54,855	151,960	56,837	156,975	58,113	160,909

### 5.3.2 Environmental

Since 2001, SEWD has voluntarily implemented several temporary fish passage improvements, including placing sandbags at road crossings to provide better depths and velocities for passage at these structures; installing a temporary Denil fish ladder at the Bellota Weir to allow fish access above the weir; installing a temporary barrier (i.e., net) at the head of the Old Calaveras River channel to prevent juveniles from entering and becoming stranded in the channel; and creating a sandbag wall on the Bellota Weir apron to direct flow into a lower fish ladder so that it would operate more effectively.

The District's Dam Removal Schedule provides information on the termination of irrigation season and when the winter weir and fish ladder is installed. Schedule is maintained at:

<http://sewd.net/2016-preliminary-dam-removal-schedule/>

SEWD has participated with the California Department of Water Resources (DWR) for a fish passage study with CH2M Hill that followed a CALFED-funded fish screen feasibility study that was completed in 2005. By 2013, fish passage improvements were completed at Budiselich Dam and Caprini Crossing. Two other fish passage improvements are planned for subsequent years; both of these projects may be completed pending additional funding.

SEWD will continue to implement interim fish passage improvements until long-term fish passage and screening solutions are identified and put into operation. All of these studies have been, or are currently being, conducted to collect information that will aid in the design and management of the long-term conservation measures and adaptive management processes that will be incorporated into the Calaveras River Habitat Conservation Plan.

SEWD also supports various research projects funded by the CALFED Bay-Delta Program and the U.S. Fish and Wildlife Service to help learn more about rainbow and steelhead trout in the river. At the request of SEWD, DWR is studying ways to improve fish passage in Mormon Slough and the Old Calaveras River. SEWD has concluded a

CALFED Bay-Delta funded study to evaluate fish screen alternatives for water diversions on the Calaveras River. SEWD is dedicated to creating a balance between environmental and water supply needs.

Additional information is available on the following websites;

<https://sewd.net/history/>

<http://www.stocktongov.com>

### 5.3.3 Recreational

SEWD does not provide direct recreational surface water. The City of Stockton has many neighborhood and community parks within the city limits, the largest of which are listed in Table 12 below. The larger regional parks, such as Oak Grove and Micke Grove, are outside of the city limits as well as the SEWD boundaries. In addition, Reclamation provides public recreation (i.e. boating, fishing, camping, picnicking, hiking, bicycling, bird and wildlife watching.) for New Melones and Hogan Reservoir.

**Table 12. Recreational water use within the District's boundary.**

Name	Estimated Acres	Description
Louis Park	74	Located on the San Joaquin River, this city park offers boat ramps and baseball and softball fields as well as the Pixie Woods Amusement Park which features a carousel, train rides, and children's theatre.
Oak Park	61	Located in central Stockton, this city park offers a large tennis complex, an ice arena, baseball and softball fields, pool, and senior citizen center.
Buckley Cove Park	53	Located on the San Joaquin River, this city park offers a boat launch.
Kennedy Memorial Park	18	Located just west of Highway 99 in southern Stockton, this county park features baseball fields, a basketball court and pool.
Giannone County Park	15	Located just west of Highway 99 in southern Stockton, this county park features baseball and soccer fields and a basketball court.

### 5.3.4 Municipal and Industrial

SEWD is under contract to supply wholesale treated surface water to public and private water suppliers within San Joaquin County. However, these supplies are not included in the agricultural water accounting.

### 5.3.5 Groundwater Recharge

Groundwater recharge consists of deep percolation that occurs from applied irrigation water, precipitation, or from delivery and drainage water in conveyance and drainage channels. The primary effort for recharge in SEWD is from the Farmington Groundwater Recharge Program (Program). This Program is led by SEWD, in partnership with the Sacramento division of the USACE. SEWD and the USACE, in a cost-share agreement, created the Farmington Groundwater Recharge Program with the intent of replenishing

the aquifer to help ensure future groundwater supply and protect against further saltwater intrusion.

The goal of the program is to recharge an average of 35,000 acre-feet of water annually into the Eastern San Joaquin Basin by 1) directly recharging surface water to the groundwater aquifer and 2) increasing surface water deliveries in-lieu of groundwater pumping to reduce overdraft and establish a barrier to saline water intrusion. In addition, spreading water on agricultural fields and other recharge basins provides seasonal migratory waterfowl habitat.

A network of agricultural wells is needed to pump stored surface water from recharge efforts and assure reliability of water supply in years when ample surface water is not available. Based on the hydrologic history of the region, more average to wet years occur than below average to critically dry years. Therefore, over the long-term, if the aquifer is recharged during all average to wet years, and groundwater pumping reliance is limited to below average to critically dry years, aquifer levels are expected to rise and stabilize.

The Program identifies areas suitable for recharge and seasonal habitat development, evaluates recharge techniques, and conducts pilot recharge tests. SEWD is continuing to identify and develop new recharge sites for this phased program. Available surplus water from SEWD's conveyance systems is diverted into recharge cells at the project site. Stored surface water would be pumped from the aquifer for agricultural, municipal, and industrial use. Recharge averaged 3,262 ac-ft between 2013 and 2015 (Table 13).

**Table 13. Groundwater recharge achieved through established recharge ponds.**

Location/Groundwater Basin	Method of Recharge	Planning Cycle		
		2013	2014	2015
		acre-feet		
Commitments/Dedicated	Percolation	4,104	3,552	2,129
Total		4,104	3,552	2,129

The recharge method of choice is field-flooding, a practice where a small perimeter levee is built at the parcel, then flooded to a depth of up to 18 inches. Because many lands in the region have a gradual slope for drainage, typical 40 to 100 acre parcels will have varying water depths ideal for a wide range of migratory waterfowl. By applying this shallow-water recharge process, lands can be rotated in and out of the program quickly and economically. Construction inputs for field flooding do not require specialized heavy equipment and, therefore, can be completed easily by the landowner.

Once a site has been identified, the four stages of the program are initiated: Stage 1, Initial Site Screening; Stage 2, Pilot-Scale Recharge Testing; Stage 3, Demonstration-Scale Recharge Testing; and Stage 4, Long-Term Operation and Maintenance. Data collected and evaluated during each of the first three stages are used to support a decision about whether a site advances to the next stage, is archived for evaluation at a future time, or is eliminated from further consideration for artificial groundwater recharge.

In 2003, SEWD completed the Pilot Phase of the Program, which consisted of 60 acres of recharge ponds and fields adjacent to the DJW WTP. The Demonstration Phase, which began in 2003, aimed to obtain 25 to 30 parcels of land, totaling 1,200 acres, for directly recharging surface water to the groundwater aquifer. District construction of an additional 35 acres of recharge ponds at the DJW WTP is in the planning stages. It is anticipated recharge rates will be slightly more than the existing 60-acre site, which currently averages over 0.5 feet per day.

The development of 1,200 acres into recharge areas is anticipated to return an estimated 35,000 ac-ft/yr of water into the groundwater basin in eastern San Joaquin County. This represents approximately 15 percent of the surface water needed for groundwater recharge on an annual basis to assure the long-term sustainability of groundwater resources for the region. As part of the Program, a Demonstration-Scale Banked Surface Water Infrastructure Project is proposed to recover surface water stored in the ground to agricultural customers and the DJW WTP. This project will include approximately 25 well site locations and associated water pipelines located adjacent to existing SEWD conveyance facilities that may be used as a long-term banked surface water infrastructure project if the demonstration scale testing is successful. The project sites are located at various sites generally east of, but within 13 miles of, the DJW WTP site noted above. The well sites are all relatively small (less than 2,000 square-feet for construction purposes, and less than 200 square-feet as a final footprint).

#### **5.3.6 Transfers and Exchanges**

The District has previously purchased water from South San Joaquin Irrigation District and Oakdale Irrigation District. Those contracts have expired. Currently, SEWD does not participate in water transfers or exchanges. In addition, transfers are not allowed between agricultural water users.

#### **5.3.7 Other Water Uses**

SEWD does not collect information on other water uses in the District, except for irrigation and municipal usage.

### **5.4 Drainage**

There are three main outflow points within the district that convey surface and subsurface outflow. These outflow points flow to the Calaveras River that subsequently flows to the Delta. Outflow is monitored using SCADA.

#### **5.4.1 SEWD Boundary Outflows**

Outflow is monitored using SCADA at three outflow locations within the district; Main Street, McAllen on Calaveras, and Mosher slough. It is estimated that 90 percent of all outflows are measured; however, the actual acreage that drains to a particular discharge location is unknown. See District Facilities Map (Attachment C), for the location of surface and subsurface outflow points, outflow measurement points, outflow water-quality testing locations.

## 5.5 Water Accounting Summary

The District's water accounting is detailed below. The accounting system was prepared considering two accounting centers: distribution system and irrigated lands.

### 5.5.1 Distribution System

Between 2013 and 2015 surface water deliveries from ranged from 33,120 acre-feet in 2014 to a low of 8,951 acre-feet in 2015 (Table 14). Groundwater pumping varies by year depending on irrigation water demand and surface water supply. There was no groundwater pumping by the District in 2013 and 2014. In 2015, SEWD pumped 5,982 acre-feet (Table 8) for delivery into the distribution system.

**Table 14. Surface water deliveries to agricultural customers 2013-2015.**

System	2013		2014		2015	
	Metered	Unmetered	Metered	Unmetered	Metered	Unmetered
	acre-feet					
New Hogan	24,184	1,821	24,336	2,330	8,951	0
New Melones	2,580	0	2,519	0	0	0
Out of District	5,595	0	3,935	0	0	0
Total	34,180		33,120		8,951	

### 5.5.2 Irrigated Lands

Water supplies for irrigation include farm deliveries from the distribution canals and groundwater pumping. Between 2013 and 2015 farm deliveries ranged from 8,951 acre-feet in 2015 to 29,185 acre-feet in 2014. Customer groundwater pumping ranged from 122,999 acre-feet in 2013 to 140,357 acre-feet per year in 2015 (Table 8).

## 5.6 Water Supply Reliability

Crop production in SEWD requires a reliable water supply to meet crop irrigation demands. The primary crops grown are walnuts, cherries, and other orchards. Acreage planted to tree and vines is increasing as more growers are transitioning to higher priced commodities. In addition, surrounding urban areas are growing thus municipal water demands are also expected to increase. One of the main efforts of SEWD is to proactively secure water supplies for agriculture and M&I uses. Given SEWD's current water supply and use its supply is considered very reliable.

The District is also involved in groundwater management activities with stakeholder groups and is evaluating conjunctive use strategies to further improve water resources sustainability. By working to integrate water resources planning across jurisdictional boundaries, the District maximizes water resources.

The District is a member of the Eastern Water Alliance, the American Water Works Association, the Association of California Water Agencies, the California Farm Water Coalition, the California Special Districts Association, the Central Valley Project Water Association, the

Central Valley Salinity Alternatives for Long-Term Sustainability (CV Salts) and CV Salts Lower San Joaquin River Committee, the Greater Stockton Chamber of Commerce, the San Joaquin Council of Governments, the San Joaquin County Farm Bureau Federation, and the Water Education Foundation. Additionally, the District seeks opportunities for Federal and State grant monies from the Reclamation and DWR.

## **6 Climate Change**

### **6.1 Introduction**

Climate change has the potential to significantly impact the water resources of eastern San Joaquin County. These impacts include: 1) changes in the volume and timing of availability of surface water supplies, 2) increased water demands 3) reduction in water quality, and 4) increased potential for flooding. These impacts on eastern San Joaquin County were analyzed and documented in the 2014 Eastern San Joaquin Integrated Regional Water Management Plan (IRWMP) (IRWMP, 2014).

The regional planning area of the IRWMP consists of 15 major water agencies, including SEWD. In this section, an analysis of climate change impacts on the water resources of SEWD is conducted by extracting relevant information about such impacts to SEWD from the 2014 IRWMP.

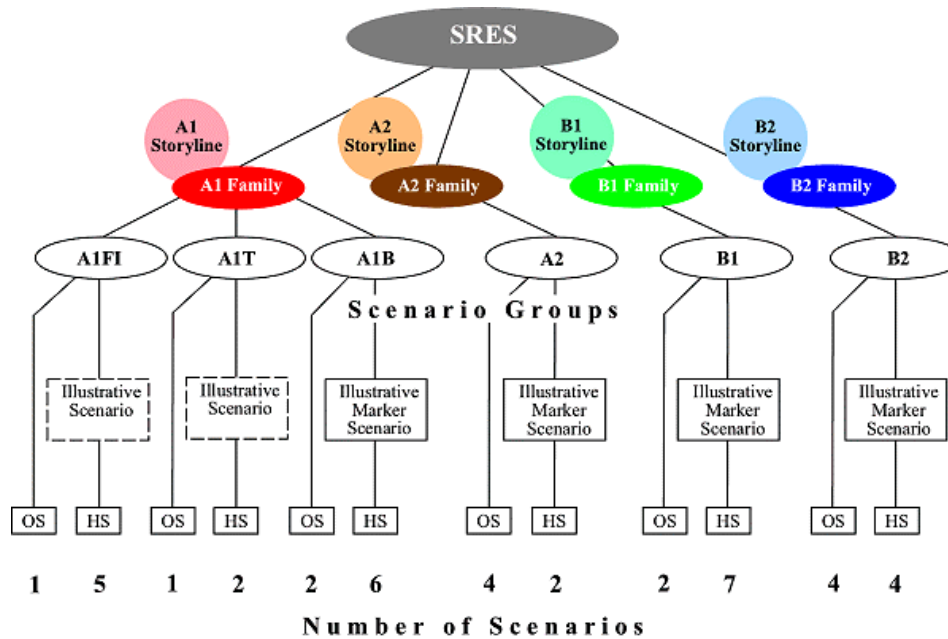
Climate change impacts on future surface water supply, water demand, water quality, and flooding potential were evaluated in the IRWMP for three future scenarios of greenhouse emissions developed by the Intergovernmental Panel on Climate Change in its Special Report on Emissions Scenarios. These three scenarios are denoted as A1B, A2, and B1 and are respectively derived from three different narrative storylines about future population growth, economic development, and energy source and use (Figure 3). Each scenario basically represents a different future in terms of levels of global greenhouse gas emissions with implied impacts on regional climate.

The A1 storyline and scenario family describes a future world of very rapid economic growth, global population that peaks in mid-century (2050) and declines thereafter, and the rapid introduction of new and efficient energy-related technologies. The A1B scenario under the A1 storyline represents a balance in the use of available fossil and non-fossil energy sources in the future. Among the three scenarios evaluated in the IRWMP, the A1B scenario is the highest greenhouse emission scenario resulting in the driest climate.

The A2 storyline and scenario family describes a heterogeneous world with the underlying theme of self-reliance and preservation of local identities. Among the three scenarios, the A2 scenario is a medium greenhouse emission scenario resulting in a moderately wet climate.

The B1 storyline and scenario family describes a convergent world with the same global population, which peaks in mid-century (2050) and declines thereafter. However, the B1 scenario reflects a rapid change in economic structures toward a service and information economy. Among the three scenarios, the B1 scenario is the lowest greenhouse emission scenario resulting in the wettest climate.

Changes in surface water supplies and water demands under the three scenarios are evaluated by comparing them to baseline conditions and are described in the following sections. Climate change impacts to water quality and flooding potential are not directly evaluated under the three emissions scenarios but are considered in a more qualitative manner.



**Figure 3. Climate change narrative storylines and scenarios developed by the Intergovernmental Panel on Climate Change.**

## 6.2 Potential Impacts on Water Supply and Quality

The two major sources of surface water for SEWD are the New Hogan Reservoir and the New Melones Reservoir. The New Hogan Reservoir receives surface water inflow from the above-reservoir region of the Calaveras River watershed. Similarly, the New Melones Reservoir receives its inflow from the above-reservoir region of the Stanislaus River watershed. Potential climate change impacts on average annual inflow to the New Hogan and New Melones reservoirs were evaluated in the IRWMP for the A2 and B1 scenarios. The baseline conditions to which these two scenarios are compared were the monthly inflows in an average year into the New Hogan and New Melones reservoirs, respectively, computed over the historical period of 1922 to 1993. These monthly inflows were extracted from results of the CALSIM II Benchmark Studies. CALSIM is a general water resources planning software developed by the DWR. The Benchmark Studies project was jointly released by DWR and Reclamation to simulate runoff into and releases from the reservoirs in the State Water Project and Central Valley Project.

Monthly inflows to the New Hogan Reservoir for an average year under the A2, B1, and baseline scenarios are presented in Figure 4. Overall, the shapes of the three curves in Figure 4 and the volumes of monthly inflow under the three scenarios are very similar. A general observation made in many climate change studies for California is that although it is uncertain whether the average annual volume of precipitation in the state will change significantly in the future, the proportion of dry precipitation relative to the total annual precipitation is expected to decrease. In other words, more precipitation will occur as wet precipitation in the higher elevations of the Sierra Nevada Mountains in the future than as snow.

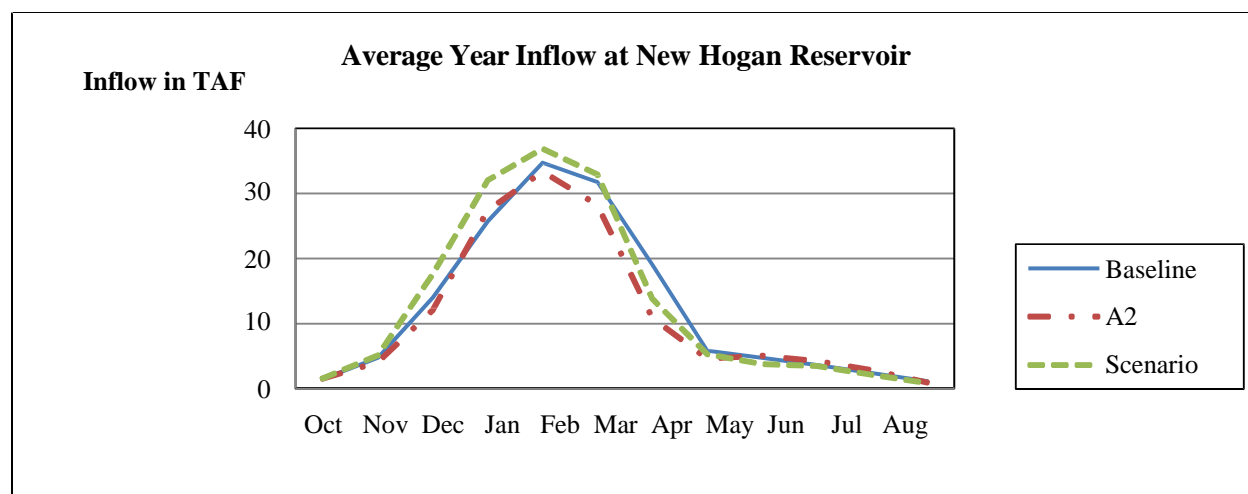
Historically, the upper region of the Calaveras River watershed has been dominated by wet precipitation with little accumulation of snow. As such, the source of surface water runoff into the New Hogan Reservoir has been predominantly wet precipitation.



Consequently, the timing of inflow into the New Hogan Reservoir as reflected by the shapes of the three curves in Figure 4 is basically the same under the two emission scenarios and the baseline scenario. Given that the surface water supply for agricultural use in SEWD is predominantly from New Hogan Reservoir, the analysis suggests that climate change will not significantly affect the timing and volume of inflow into that reservoir under the two emission scenarios (A2 and B1).

Monthly inflows to the New Melones Reservoir for an average year under the A2, B1, and baseline scenarios are presented in Figure 5. Under the baseline scenario for the New Melones Reservoir, peak runoff historically has occurred during late spring and early summer due to delayed melting of the snowpack in the upper watershed of the Stanislaus River. Peak runoff under the A2 and B1 scenarios occurs during winter and early spring; however, reflecting the general thought by scientists that wet precipitation in the higher elevations of the Sierra Nevada Mountains will increase in the future along with a concomitant decrease in snowpack. The areas under the curves in Figure 5 for scenarios A2 and B1, however, are larger than that of the baseline scenario, suggesting that the total volume of runoff into the New Melones Reservoir may increase in the future due to climate change albeit mostly in the form of wet precipitation. Since surface water supplies from the New Melones Reservoir for SEWD are predominantly used for urban use, the impact on agriculture of the projected shift in the timing of peak runoff from New Melones Reservoir in the future is unclear.

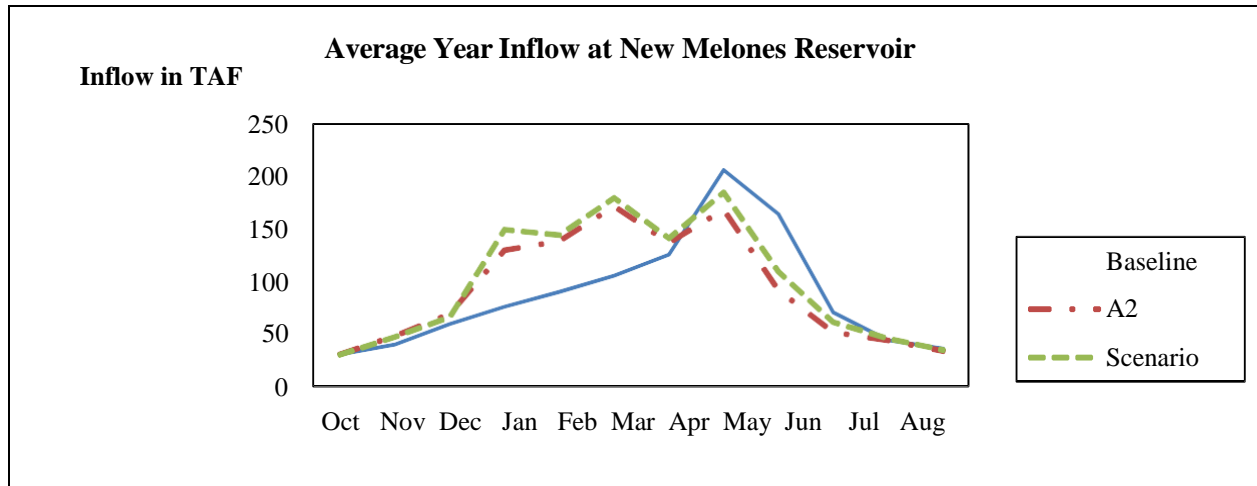
Potential impacts of climate change on the quality of surface water include increases in turbidity, suspended sediments, water temperature, and salinity. Increases in turbidity and suspended sediment load in storm water runoff may occur if severe storms become more frequent and result in an increase in accelerated erosion. An increase in the temperature of surface water runoff is expected given the projected increase in the proportion of wet precipitation occurring during the rainfall season and the overall increase in average daily minimum and maximum temperatures during each season.



**Figure 4. Monthly runoff into the New Hogan Reservoir for an average year under baseline, A2, and B1 scenarios.**

As reported in the IRWMP, sea level rise of up to 12 inches is predicted by 2050 and of up to 66 inches by 2100. An increase in the salinity of both surface water and groundwater may occur, due to sea level rise, if seawater intrusion into the SEWD service

area occurs. However, the City of Stockton lies between the Sacramento-San Joaquin Delta and the western boundary of the SEWD service area. As such, the immediate effects of sea level rise on the potential for seawater intrusion in the SEWD service area is uncertain.



**Figure 5. Monthly runoff into the New Melones Reservoir for an average year under baseline, A2, and B1 scenarios.**

### 6.3 Potential Impacts on Water Demand

Seasonal levels of climate variables for an average year over the future period of 2010 to 2050 were estimated in the IRWMP under greenhouse emission scenarios A1B, A2, and B1. These six variables are precipitation, minimum temperature, maximum temperature, wind speed, evapotranspiration, and runoff. Baseline conditions (seasonal levels for an average year in the past) for the six variables were estimated using historical data for the period of 1971 to 2010. These baseline conditions represented a baseline scenario to which the results of the three emission scenarios were compared in the IRWMP. Changes in the six climate variables relative to the baseline scenario under each of the three scenarios were calculated for each season (winter, spring, summer, and fall) and for the average year in total (Table 15) (IRWMP, 2014).

The highest water use sector in the SEWD service area is irrigated agriculture. A combination of surface water and groundwater has historically been applied to the agricultural lands in the area over typical irrigation cycles (i.e., approximately April through September) to satisfy the evapotranspiration demands of perennial and annual crops grown. In the IRWMP, evapotranspiration during winter was estimated to decrease under scenarios A1B, A2, and B1 by 2.1, 4.4, and 4.8 percent (Table 15). However, evapotranspiration during the spring, summer, and fall was estimated to increase under each of the three future emission scenarios. Overall, annual evapotranspiration was estimated to increase by 5.4, 2.8, and 2.7 percent under scenarios A1B, A2, and B1 (Table 15).

**Table 15. Changes in projected seasonal and annual climate variables between baseline and scenarios A1B, A2, and B1.**

Climate Factor	Climate Scenario	Projected Change				
		Winter	Spring	Summer	Fall	Annual
Precipitation	A1b	4.6	-19.9	-48.2	-8.4	-6.2
	A2	12.6	-24.8	-19.9	-0.3	-2
	B1	15.5	-16.7	-2.6	10.9	4.9
Max Temperature	A1b	8.3	4.6	5.3	6.2	5.8
	A2	3.5	4.4	5	3.8	4.3
	B1	7.4	4.8	3.9	4.8	4.8
Min Temperature	A1b	19.4	9.5	11.7	14.5	12.8
	A2	19.5	12.1	10.1	9.6	11.5
	B1	28.2	8.4	8.9	9.6	11.1
Wind	A1b	0.6	-0.3	0.2	1.1	0.3
	A2	-1.4	2.7	-1.7	-0.2	-0.2
	B1	1.2	-0.05	-0.2	-1	-0.1
Evapotranspiration	A1b	-2.1	4.9	6.7	6.2	5.4
	A2	-4.4	4	4.1	1.2	2.8
	B1	-4.8	3.5	3.8	2.5	2.7
Runoff	A1b	6.6	-15.2	-3.8	-4.2	-2.9
	A2	17.4	-12.7	-1.1	5.5	3.8
	B1	62.1	6.5	-0.8	12.2	34.6

Historically, the rain season in Central Valley has extended from late fall to early spring. In the IRWMP, precipitation during winter was estimated to increase under scenarios A1B, A2, and B1 by 4.6, 12.6, and 15.5 percent (Table 15). Over the course of the average year, however, precipitation was predicted to decrease under scenarios A1B and A2 by 6.2 and 2.0 percent while increasing under scenario B1 by 4.9 percent (Table 15).

A separate analysis estimated the anticipated change in the number of growing-degree days during each season under the three scenarios in comparison to a baseline scenario (Table 16). In general, the number of growing-degree days in each season increased under each scenario in comparison to the baseline scenario of seasonal growing-degree days.

Considered together, the increase in annual evapotranspiration, possible decrease in annual local precipitation, and the increase in the number of growing-degree days for each season; suggest that climate change may result in shorter growing seasons for individual crops with concomitant higher daily evapotranspiration rates during growing seasons of those crops. Increases in minimum and maximum seasonal temperatures, also suggest the possibility of a longer overall growing season for each year that could potentially accommodate multiple-cropping patterns. For an individual crop, it is unclear whether the balance between a shorter growing-season, reduced annual rainfall, and an increase in daily evapotranspiration rates will translate into a greater or lesser overall irrigation demand for the crop during its growing season.

**Table 16. Changes in growing degree-days between scenarios baseline, A1B, A2, and B1 scenarios.**

Climate Factor	Climate Scenario	Projected Change Summer			
		Winter	Spring	Summer	Fall
Growing Degree Days	A1b	155	284	298	292
	A2	98	248	274	184
	B1	70	206	175	142
Heating Degree Days	A1b	-298	-183	-5	-145
	A2	-209	-174	-4	-97
	B1	-147	-139	-2	-78
Cooling Degree Days	A1b	0	29	306	73
	A2	0	14	285	47
	B1	0	17	178	41

#### **6.4 Potential Strategies to Mitigate Climate Change Impacts**

Since its inception, the mission of SEWD has been to manage and protect its groundwater supplies and to provide a reliable supply of surface water to its urban and agricultural customers. SEWD attempts to achieve those goals by managing the surface water and groundwater supplies in its service area conjunctively. To address the uncertain impacts of future climate change on the volume and timing of availability of surface water supplies, SEWD should continue with an aggressive surface water-groundwater conjunctive use management program. It should expand its recharge programs by incorporation of additional percolation basins that will enable SEWD to accept and recharge surface water when it becomes available SEWD should also continue to expand its conveyance system into areas of its service area where farmers traditionally pump groundwater and to areas where additional percolation ponds can be added to its recharge programs.

With respect to adapting to changes in water demands, farmers in the SEWD service area will naturally respond to changes in evapotranspiration demands due to climate change by choosing crops with growing seasons consistent with the local climate and irrigation demands that can be met by available surface water and groundwater supplies. Localized flooding due to the increased occurrence of severe storms can be managed by expansion of the surface water conveyance system to route storm water runoff to dedicated flood and percolation basins for flood control and subsequent groundwater recharge. Dedicated flood and percolation basins can also be a means for improving the water quality of storm water runoff through sedimentation of suspended solids and filtration of turbid surface water by deep percolation through subsurface sediments.

## **7 Best Management Practices**

Under Reclamation criteria there are two categories of best management practices (BMP); critical and exemptible. Critical BMPs are those that every Reclamation agricultural District is required to implement. These BMPs are considered to be the basic elements of good water management. Exemptible practices are those that agricultural Districts should implement unless the District demonstrates that the practice is not appropriate or not cost-effective.

In addition to the narrative on Reclamation BMPs, Table 18 provides the status of the State's efficient water management practices (EWMPs). Reclamation reporting for 2013 through 2015 is listed in Attachment H.

### **7.1 Critical BMPs**

Critical BMPs include water measurement, water conservation coordinator, on-farm water management activities, information on water quality, pricing, and efficiency of District pumps. Details on these BMPs are as follows.

Measure the volume of water delivered by the district to each turnout with devices that are operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- 6%

In 2015, there were 201 connections with 193 of the connections measured with volumetric or hour meters. The 193 measured connections include two connections that were retrofitted in 2015. SEWD is planning on retrofitting two additional connections in 2016. All water meters in service are tested in accordance with the manufacturer's recommendations.

There are several contributing factors for the delivery points that do not have a measuring device. Field conditions contributing to the installation issues are the following: old pump stations (see Attachment L) with complicated plumbing, and insufficient pipe lengths. SEWD is reviewing alternatives for measurement at the eight unmeasured locations (Attachment J).

The District is developing a meter replacement/repair program that it believes it can be implementable over a 5-year period; however, further meter exploration is required before the District can select a device or method for wide scale implementation. This could be accomplished through development of a meter Pilot Program that could begin structuring a meter replacement/installation program to improve delivery point water measurement within the District.

The Pilot Program would have to be locally cost effective and comprised of the following criteria:

- The Program must be locally cost-effective and achieve the most "bang-for-the-buck" during implementation;
- The Program could employ water measurement using a combination of individual customer turnout measurement devices and lateral level (upstream) turnout measurements to multiple customers on private laterals;

- Measurement devices and methods will be standardized as-much-as possible, so that standardized operations can be used at delivery points throughout the district. Devices or methods used for canal and pipeline measurement would likely be different;
- For permanent installations on the largest delivery points, it may be desirable for the measurement device to indicate the instantaneous flow rate and the accumulated volume delivered, and be readable in the field by both District staff as-well-as the agriculture water user. With a provision allowing data to be transmitted to a SCADA system in the future, if desired;
- The measurement device must be a proven technology that the District and the agricultural water user can easily understand; and
- The ability to secure the measurement device is important to prevent, or at least hinder, theft and vandalism.

**7.1.1 Designate a water conservation coordinator to develop and implement the Plan and develop progress reports**

Water Conservation Coordinator;  
Kristin Coon  
6767 East Main Street, Stockton, CA 95215  
209-444-3126  
[kcoon@sewd.net](mailto:kcoon@sewd.net)

**7.1.2 Provide or support the availability of water management services to water users**

This BMP has five categories of support for water management services; on-farm evaluations, real-time irrigation scheduling, water quality information, educational programs and materials, and other.

**a. On-Farm Evaluations**

1. On farm irrigation and drainage system evaluations using a mobile lab type assessment

Using grant funding from Reclamation, SEWD has provided irrigation evaluations free to its customers since 1999. The evaluations have been promoted through SEWD's annual newsletter, the District Advisory Committee (comprised of stakeholders representing the urban and agricultural areas of SEWD), and through District field personnel. The irrigation evaluation program is voluntary, but is encouraged and supported by SEWD. SEWD will continue to offer this service free to its customers.

The actual cost of an irrigation evaluation is \$2,500. Offering this evaluation free to customers represents greater than a 25 percent discount on the cost of the evaluation, thereby complying with the Reclamation's example of an adequate program per the USBR Water Management Plan 2008 Guidebook: Offer to district water users a rebate or discount of 25 percent off the fair market price of an evaluation. In 2015, one farm was surveyed and seven pumps were tested.

2. Timely field and crop-specific water delivery information to the water user

Meter readings are collected monthly. SEWD prepares an annual crop report on water use per crop, method of irrigation, estimated water use and metered use. This report is posted at the SEWD office.

b. Real-time and normal irrigation scheduling and crop evapotranspiration (ET) information

SEWD provided daily and seven-day-average ET information from the Lodi West (Station 166) and Manteca (Station 70) through its CIMIS Hotline beginning in January 1998. From 1998 to 2004 there were no inquiries; therefore, the hotline was discontinued.

Subsequently, for customers to obtain ET information, SEWD provided a link to the CIMIS web site on the home page of SEWD's web site, and had signage at SEWD's office directing customers to the California Irrigation Management Information System (CIMIS) web site. SEWD's spring and fall newsletters, which are delivered to all of SEWD's customers, also provided the link to the CIMIS website. However, although growers could calculate the ET for their crop based on information available on the CIMIS website, including applying crop coefficients for the particular crop, and entering the age of their crop, the CIMIS website did not provide crop-specific information.

Consequently, the Irrigation Training and Research Center (ITRC) at California Polytechnic State University, San Luis Obispo, working under a technical services agreement with the U.S. Bureau of Reclamation Mid-Pacific Region, undertook a review of the procedure and materials used to create estimates for Irrigation Allowance Index evaluations and Crop Water Requirements for the growers in SEWD. These values can be used to create a real-time, irrigation scheduling tool for growers as well as a simple evaluation of total water use at the end of the irrigation season. A list of crops and crop evapotranspiration (ETc) values was compiled specifically for SEWD to provide growers with a resource for irrigation management. A complete explanation of the methodology, as well as the irrigation allowance values and the irrigation allowance index developed for SEWD growers, is available to growers upon request.

c. Surface, ground, and drainage water quantity and quality data provided to water users

SEWD began irrigation water quality monitoring for surface water at seven key points in the irrigation distribution system in 1997. The results are displayed on SEWD's web site and Water Conservation Information table at the SEWD office.

d. Agricultural water management educational programs and materials for growers, staff, and the public include the Ag. Water Report with a circulation of 6,500 and the State of the City event with 2,000 attendees.

e. Other

Agricultural BMPs are incorporated into SEWD's daily operations.

**7.1.3 Pricing structure - based at least in part on quantity delivered. Describe the quantity-based water pricing structure, the cost per acre-foot, and when it became effective.**

SEWD's surface water pricing structure is based on the quantity of water delivered and is charged at a rate of \$23.00/ac-ft. In most cases quantity of water delivered is based on water meters. In cases where installation of a water meter would require capital improvements to the private owner's water pumping system, water quantity is determined using pump tests and hour meters.

Domestic groundwater users are charged a flat rate of \$43 for a private well. There is no water conservation pricing structure because SEWD is not selling the water, but assessing for the use of a well. In addition, on a volumetric basis agricultural groundwater users are assessed \$5.06 for each acre-foot pumped. Water rates are published annually on the District's website posted as Ordinance 42. A copy of the 2016 rate schedule is included in Appendix D.

**7.1.4 Evaluate and describe the need for changes in policies of the institutions to which the district is subject**

SEWD has three water contracts all with different contract years. For ease of scheduling and providing the most economical water for our customers, SEWD continues to negotiate for a standard contract year.

**7.1.5 Evaluate and improve efficiencies of District pumps**

*Describe the program to evaluate and improve the efficiencies of the contractor's pumps.*

SEWD owns two pumps that pump water from the Calaveras River into Potter Creek for irrigation. In 2001, modifications were made to SEWD's Bellota Pipeline, which allowed for gravity flow from the SEWD pipeline to Potter Creek. Since no SEWD pumping has been required to supply irrigation water to Potter Creek since 2001, the cost savings realized are comparable to those of 2001 expenses, approximately \$30,000. This practice can only be used when there is an adequate water supply from both the New Melones and New Hogan water contracts. The pipeline is dedicated to M&I use only when SEWD is relying 100 percent on the New Hogan water supply.

**7.2 Exemptible BMPs for Agricultural Contractors**

**7.2.1 Facilitate alternative land use**

*Describe how the contractor encourages customers to participate in these programs.*

No programs have been developed to encourage alternative land uses because SEWD does not include lands that have these chronic issues.



**7.2.2 Facilitate use of available recycled urban wastewater that otherwise would not be used beneficially, meets all health and safety criteria, and does not cause harm to crops or soils**

SEWD's agricultural area is primarily upstream of available urban recycled wastewater and considerable pumping would be required to provide recycled water to SEWD customers. Recycled urban wastewater use was investigated in a 1995 study by the City of Stockton, which operates the wastewater treatment facility. Until recently the City did provide some water to a farmer located near the wastewater treatment plant, but the discharge permit was not renewed and no wastewater is being recycled at this time. SEWD supports the City of Stockton's recycling efforts.

**7.2.3 Facilitate the financing of capital improvements for on-farm irrigation systems**

SEWD currently offers a Surface Water Incentive Program. This program encourages the conversion to surface from groundwater through water pricing. The owner of the pumping facility is charged the groundwater assessment rate for water until the capital costs of the facility have been amortized. This program is noticed in SEWD's Ag Newsletter and on its web page. Three irrigators have taken advantage of this program to date.

In 1996, SEWD provided zero interest loans for a pumping facility to customers who switched from groundwater use to surface water use. SEWD provided \$1.3 million in loans. Funding sources for these loans were the subject of a lawsuit between SEWD and the urban contractors. In 1999, the zero percent loan program was discontinued. SEWD continues to provide information to its customers on other loan programs as they become available.

**7.2.4 Incentive pricing**

SEWD's enabling legislation (Attachment E) limits its ability to offer pricing incentives for water pricing.

**7.2.5 Line or pipe ditches and canals**

SEWD has two canal systems, Upper Farmington Canal and Lower Farmington Canal, which are part of the New Melones Conveyance System. SEWD utilizes natural creeks, sloughs, and rivers to distribute water. Percolation from these natural watercourses provides recharge to the groundwater basin. Over time, SEWD collected data to verify percolation from its unlined canals: Upper Farmington Canal and Lower Farmington Canal. Percolation from both canals was found to be minimal (less than 5 percent). Percolation was addressed in an Environmental Impact Report for the canal system. SEWD and CSJWCD, which also uses the Upper Farmington Canal for transport of New Melones water, are situated over the Eastern San Joaquin Groundwater Basin, which is critically overdrafted. Percolation is reclaimed through groundwater pumping as a component of SEWD's conjunctive use plan. This BMP has been deemed complete.

Leaks can occur on the conveyance canal system that are unlined canals and around concrete structures. The efficiency of the canal system is improved by the District's routine canal inspection and maintenance program that serves to locate, and repair both

potential and current leaks. Once an area of canal is surveyed, a punch list of repair items is compiled and used to correct deterioration and other issues. Due to the destructive nature of rodents, a rodent abatement program is also a component of the District's inspection and maintenance program. This approach allows for many needed repairs to be made before leaks have a chance to occur.

#### **7.2.6 Construct regulatory reservoirs**

The reservoirs surrounding the treatment plant act as buffers during storm events and percolate water, recharging the aquifer at the treatment plant. Reservoir maintenance and groundwater monitoring are ongoing.

Construction of an additional regulatory and percolation pond is in the planning stages. Funding is being sought from the USACE and local funds.

#### **7.2.7 Increase flexibility in water ordering by, and delivery to, water users**

SEWD operates an on-demand system. SEWD requires customers to call or email 24 hours in advance. This advance notice helps SEWD manage its irrigation supplies more efficiently. This system has flexibility in water ordering and delivery to the water user. The overall system is working well; however, SEWD is having problems with the SCADA system and is reviewing new software programs to improve the system.

#### **7.2.8 Construct and operate District spill and tailwater recovery systems**

USBR grant funds are utilized for this BMP. SEWD will continue to apply for these grants as they become available. In 2005, SEWD applied for and was awarded a Challenge Grant in the amount of \$150,255 over two years to implement a SCADA system. SEWD's contribution was \$154,553. Although SCADA is not a spill or tail water recovery system, it allows enhanced surface water management abilities which should minimize already limited system losses. The equipment was installed in 2006; however, SEWD is still adjusting the SCADA system for optimum performance.

There is no plan to pump the limited system losses upstream. SEWD would need to build the costly facilities to pump this relatively small volume of water over 20 miles upstream. Currently, this water flows downstream and is put to beneficial use either by other growers or by flowing into the San Joaquin River. A cost-benefit analysis performed in 2011 and is provided in Attachment F.

#### **7.2.9 Plan to measure outflow.**

Municipalities served by the District system (City of Stockton, CAL Water, and County of San Joaquin) receive water on a bulk basis and are required to meter the water and provide a meter signal back to the District on a continual basis. The District's SCADA screen shows the rate of flow and the total flow for each municipality. The municipalities also provide monthly-totalized statements on water flow that the District uses to track water use and plan water deliveries.

As mention in section 5.4.1 in this document outflow is monitored using SCADA at three outflow locations within the District; Main Street, McAllen on Calaveras, and Leffler on

Mosher. It is estimated that 90 percent of all outflow is measured; however, the actual acreage that drains to a particular discharge location is unknown.

#### **7.2.10 Optimize conjunctive use of surface and ground water**

SEWD's goal is to optimize conjunctive management of surface and groundwater. SEWD secures and provides supplemental water to protect the District's only reliable water supply, groundwater. SEWD is looking for more recharge sites. See Section 4.3 for more information. In 2015, SEWD rehabilitated four wells and constructed a new one for supplemental M&I service.

#### **7.2.11 Automate canal structures**

This BMP is being implemented in conjunction with BMP B7.

#### **7.2.12 Facilitate or promote water customer pump testing and evaluation**

SEWD promotes its own pump-testing program for its customers. SEWD has received USBR grant funding and offered free pump tests and irrigation evaluations to its customers. SEWD completed 3 pump tests in 2010, and three more in 2011. The pump tests are promoted in SEWD's twice annual newsletter, at Stockton East Advisory meetings and through SEWD field personnel communication with customers. For meter installation on existing surface water pumps that require major capital costs, SEWD offers pump hour meter installation in conjunction with a free pump test to quantify water use.

## **8 Supplemental Information**

This section covers the following supplemental information required by SB x7-7.

- Legal Certification and Apportionment Required for Water Measurement
- Engineer Certification and Apportionment Required for Water Measurement
- Water Measurement Best Professional Practices
- Description of Water Measurement Conversion to Volume
- Device Corrective Action Plan Required for Water Measurement
- Summary of Efficient Water Management Practices

### **8.1 Legal Certification and Apportionment Required for Water Measurement**

SEWD is able to measure approximately 96% of its agricultural meters. However, SEWD faces challenges and is unable to measure water at the farm-gates for customers equipped with this type of system. In addition, there are some laterals (upstream of multiple customers) that cannot be measured due to the type of piping system that's been installed. Therefore, SEWD does not need to submit engineer certification and apportionment required for water measurement.

A recent field investigation conducted by SEWD, determined that ten previously unmetered customer delivery could not be metered. Of those two meters have already been installed, and eight sites remain unmetered. There are constraints at the farm-gates and at some of the irrigation outlets that prevent the installation or operation of water meters. These unmetered locations have been identified in Attachment J.

### **8.2 Engineer Certification and Apportionment Required for Water Measurement**

SEWD can measure water at the farm-gate for all customers and does not measure at the lateral (upstream of multiple customers). Therefore, SEWD does not need to submit engineer certification and apportionment required for water measurement. This DWR Attachment B requirement is not applicable to SEWD.

A 2013 field investigation conducted by SEWD determined that the ten previously unmetered customer delivery points could not be metered, however, two of those meters were installed in 2015. Implementation of a meter replacement/calibration program and new meter Pilot Program is outlined in Section 7.1.

### **8.3 Water Measurement Best Professional Practices**

#### *Water Measurement Data Collection*

Water measurement data are collected via manual readings. SEWD uses a certified pump tester to calibrate their meters. An SEWD engineer reviews and approves the pump tests.

#### *Measurement Frequency*

Meter readings are collected every 30 days during use.

### *Method for Determining Irrigated Acres*

SEWD requests that each of their agricultural customers reports on their agricultural irrigation use for the previous year. Customers are sent an *Owner's Water Use Statement for Calendar Year (the upcoming calendar year)*, and must return it to SEWD by mid-January. Customers are asked to report the following data and information:

1. crops grown,
2. method of irrigation,
3. acres fallow/not irrigated,
4. acres being irrigated with well water, and
5. acres being irrigated with surface water.

The customers are also asked to report non-agricultural irrigation use. The Owner's Water Use Statement requires acknowledgement that the information submitted is truthful under penalty of perjury. If the form is not turned in by the requested date, a 5 percent penalty is added to the customer's water bill.

### *Quality Control and Quality Assurance Procedures*

Information provided by the customers on the Owner's Water Use Statement for Calendar Year (the upcoming calendar year) form sent out annually by SEWD is cross-checked by the District using water meter readings. SEWD first compares customer current water use with historical use to identify potential metering inaccuracies or errors. For any suspected inaccuracies or errors, SEWD then conducts a further investigation with the customer, including conducting a detailed meter inspection or testing.

SEWD conducts water audits for the DJWWTP. SEWD measures their diversions, the amount treated at the DJWWTP, and the amount delivered to its urban customers. Any discrepancies are immediately investigated, and repairs made as necessary.

Since 2013, SEWD has retrofitted 20 connections with meters and upgraded two existing meters. Newly installed meters include certificates of calibration (Attachment K). Currently, there are eight unmeasured connections and the District is looking to implement a meter replacement and calibration program as-well-as a new meter Pilot Program

It was determined that the PG&E hour meters used for eight customers have an accuracy well above +/- 6 percent. SEWD has not replaced the remaining hour meters or has retrofitted the irrigation outlets with only PG&E meters, since they have installation constraints (Attachment J). In order to make appropriate corrections for the irrigation outlets, the District must explore all viable options that are cost-effective, and functional.

The PG&E meters and hour meters that remain throughout SEWD's conveyance system including the following:

- CR-08 – Same Owner, Lower Calaveras
- CR-08A– Same Owner, Lower Calaveras
- C-18A- Upper Calaveras

#### PG&E Meters:

- CR-14 – Lower Calaveras
- CR-30 – Lower Calaveras
- CR-66 – Lower Calaveras

- CR-79A – Lower Calaveras
- M-44 - Mormon Slough
- M-55 - Mormon Slough
- C-16 – Upper Calaveras

#### **8.4 Description of Water Measurement Conversion to Volume**

For SEWD water measurement devices that are not measuring water volume, the water measurements are obtained from flow meters by taking the gallons per minute rating of the pump and the run time reading from each pump system to calculate usage through the following formula:

$$(pump\ flow\ in\ gallons\ per\ minute) \times (1\ ft^3 / 7.481\ gal) \times (1\ acre / 43,560\ ft^2) \times total\ minutes\ pump\ is\ operating = total\ acre\text{-}feet\ (volume)$$

A similar water measurement conversion to volume procedure is used for the PG&E or hour meters; however, all pumps measured by pump test, run time or PG&E readings will be replaced over the next three years (by 2015) in order to obtain more accurate volume reading measurements.

#### **8.5 Device Corrective Action Plan Required for Water Measurement**

As stated in section 8.3, SEWD has retrofitted 20 connections since 2013 with meters and currently has eight unmeasured connections that have installation constraints, an implementation program is outlined in Section 7.1. Below is an outline of the corrective actions remaining (Table 17).

**Table 17. Schedule to implement EWMPs (Table E-1. (DWR Table VII.A.3)).**

EWMP	Implementation Schedule	Finance Plan	Budget Allotment
<i>Critical</i> EWMP 1: Water Measurement	Meter options will be explored and potentially piloted at unmeasured turnouts based on feasibility and cost effectiveness.	Monies will be transferred to the water meter maintenance category from the Ag Division Fund 67 budget to cover planned meter installations.	\$6,000 in 2016 <sup>a</sup>
<i>Critical</i> EWMP 1: Water Measurement	A total of 20 meters were replaced from 2013 thru 2015. In addition, 10 irrigation outlets remain that are solely metered by an PG&E and/or hour meter, and viable options will be explored for replacing.	Monies will be transferred to the water meter maintenance category from the Ag Division Fund 67 budget to cover planned meter replacements.	\$13,000/year for 2014 and 2015 <sup>a</sup>
<i>Critical</i> EWMP 1: Water Measurement	A work plan is being developed for replacing and/or calibrating the District's existing water meters each year.	Monies will be transferred to the water meter maintenance category from the Ag Division Fund 67 budget to cover planned meter calibrations.	\$5,000/year

<sup>a</sup> These monies include budget to cover unplanned but needed meter replacements

## 8.6 Efficient Water Management Practices

Table 18 summarizes the implementation status of each EWMP.

**Table 18. Summary of EWMPs (Water Code §10608.56(d)).**

EWMP	Implementation Schedule	Finance Plan	Budget Allotment <sup>1</sup>	USBR 2011/2014 Criteria
<b>Critical</b>				
1 – Water Measurement	All metered	NA	6,277	Critical 1
2 - Volume-Based Pricing	Volumetric pricing	NA	staff time	Critical 4
<b>Conditional</b>				
1 – Alternate Land Use	No problem areas	NA	staff time	Exemptible 1
2 – Recycled Water Use	Not applicable	NA	staff time	Exemptible 2
3 – On-Farm Irrigation Capital Improvements	Surface Water Incentive Program	NA	850	Exemptible 3
4 – Incentive Pricing Structure	Not applicable <sup>2</sup>	NA	staff time	Exemptible 4
5 – Infrastructure Improvements	Implemented	NA	111,000	Exemptible 5a Exemptible 5b
6 – Order/Delivery Flexibility	Implemented	NA	staff time	Exemptible 6
7 – Supplier Spill and Tailwater Systems	On-going	USBR Grant	staff time	Exemptible 7
8 – Conjunctive Use	Implemented	NA	1,200	Exemptible 9
9 – Automated Canal Controls	On-going	USBR Grant	staff time	Exemptible 10
10 – Customer Pump Test/Eval.	On-going	USBR Grant	675	Exemptible 11
11 – Water Conservation Coordinator	On-going	NA	3,000	Critical 2
12 – Water Management Services to Customers	On-going	NA	6,600	Critical 3
13 – Identify Institutional Changes	On-going	NA	staff time	No equivalent
14 – Supplier Pump Improved Efficiency	On-going	NA	staff time	Critical 5
Grand Total all EWMPs				

Note: There is no equivalent USBR Conditional EWMP #13 or #14

1 Amounts are in addition to staff time.

2 SEWD's enabling legislation limits its ability to offer incentive pricing.



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